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ABSTRACTS OF CURRENT LITERATURE

SURGERY OF THE HEAD AND NECK

HEAD

Hyndman, O. R.: Treatment of Major Wounds of the Skull. Cerebral Fungus; Its Treatment by Skin Grafting. *Surgery*, 1942, 11: 466.

If a major cranial defect is sustained so that an area of cerebrum 1 in. or more in diameter is exposed and becomes infected, a herniating mass of infected and inflamed brain tissue will usually ensue. The infected hernia cerebri is commonly referred to as a fungus. The fungus is highly intractable to treatment and often leads to death. The surgeon is sooner or later tempted to amputate the herniated mass flush with the skull, only to be confronted with a recurrence. The most important factor which makes the lesion unique is the poor grade of granulation tissue over which the epithelium might grow.

It has hitherto been a custom in neurological surgery not to cover exposed brain with gauze but with some smooth tissue such as gutta percha. Such a dressing does not encourage the development of granulations. The author in 2 cases provoked the growth of granulations by means of gauze dressings. These granulations were later receptive to small deep skin grafts which were followed by complete healing. As healing took place the fungus receded spontaneously. DAVID J. IMPASTATO, M.D.

Mackby, M. J.: Cephalic Bruit. A Review of the Literature and a Report of 6 Cases. *Am. J. Surg.*, 1942, 55: 527.

The author deplores the nearly lost art of auscultation of the skull and points out that much valuable information can be obtained by routine employment of the procedure.

In a review of the literature concerning cephalic bruits, Mackby reveals some facts which appear to be little known. Apparently, cephalic bruits are common in infants whose fontanelles are open, although they are not uncommon in children whose fontanelles have closed. In rachitic children especially, bruits are commonly heard. Cranial bruits have also been observed in anemic patients, which indicates that changes in the physical composition of the blood are sufficient to produce them. However, most cranial bruits are caused by obvious pathological lesions such as arteriovenous fistulas, aneurysmal varices, and tumors with wide vascular channels. Simple arterial aneurysms are a rare cause of bruits —in only 2 of 555 cases collected by Beadle were murmurs heard on auscultation.

Bruits may be heard in cases of glioma of the brain, although the murmurs are attributable, not to the vascularity of the tumor *per se*, but to a disturbance of the circulatory dynamics of that region of the head.

The author presents 6 cases in which clearly heard bruits were present over various areas of the skull and were diminished by carotid compression. In Case 1 the lesion was a medulloblastoma of the vermis; in Case 2 a craniopharyngioma; in Case 3 an astrocytoma of the third ventricle; in Case 4 an unclassified glioma of the fourth ventricle; in Case 5 a subdural hematoma; and in Case 6 a hemangioblastic malformation in the sylvian fissure.

The author's material seems to indicate that bruits are not confined to tumors, malformations, and injuries of the blood vessels, but may be heard in a variety of conditions. He states categorically, however, that no audible sounds are heard over any part of the head in a normal adult subject. This conclusion was substantiated by examination of 75 healthy people, none of whom had cephalic murmurs.

In addition, 175 patients from the wards and outpatient department of the Brooklyn Hospital, Brooklyn, New York, were examined. In this group 3 cases of cephalic bruit were found, but in each instance the patient had vavular cardiac disease.

LAURENCE M. WEINBERGER, M.D.

Grantham, E. G., and Smolik, E. A.: Calcified Intracerebral Hematoma. *Ann. Surg.*, 1942, 115: 465.

Large, solitary, intracerebral hematomas are not a common complication of head trauma but must be considered in patients with focal symptoms and increased intracranial pressure following injury to the head. Many intracerebral hematomas of small size are presumably absorbed. For a large hematoma to become completely calcified is a rare occurrence.

Fig. 1. Right lateral view of the skull showing the calcified mass lying in the right occipital lobe. The shadow was about 4 cm. in diameter. (Courtesy of J. B. Lippincott Co.)

The authors report such a case in a forty-six-year-old Negro whose head was injured at the age of thirteen. About one month after the injury he had his first convulsive attack. The seizures recurred at intervals and had been treated with luminal for many years. On admission to the hospital the patient also complained of pain in the right eye. Neurological examination revealed a complete left homonymous hemianopsia. The pupils were equal and reacted to light. There were no other significant clinical findings except roentgenological demonstration of a calcified mass in the right occipital lobe. The mass appeared to be about 4 cm. in diameter (Fig. 1.). It was successfully removed and pathological examination showed that it was a calcified hematoma. Cure of the convulsive seizures was not anticipated, but it was expected that surgical removal would facilitate their control with dilantin.

JOHN L. LINDQUIST, M.D.

EYE

Lemere, F.: Electroencephalography as a Method of Distinguishing True from False Blindness. *J. Am. M. Ass.*, 1942, 118: 884.

As there has never been a reliable objective test for blindness, a physician suspecting hysterical blindness or malingering may be unable to confirm his diagnosis. Conversely, the physician may feel confident that a patient is not a malingerer and yet may be unable to prove genuine blindness. The value of a reliable objective test for blindness, especially in compensation cases and in military medicine, is obvious.

Electroencephalography is a method of recording the electrical activity of the brain, roughly analogous to the use of electrocardiography in studying the activity of the heart. The most prominent brain waves are the alpha waves with an approximate rhythm of 8 per second. These waves appear only with the eyes shut, as they arise almost entirely from the visual cortex and are broken up when the eyes are open and the subject looks at an object.

A uniform visual field of light or dark, or even a field containing blurred indefinite outlines, usually does not interrupt the alpha rhythm. It requires a definite visual pattern to break the alpha rhythm. If a blind or partially blind subject attempts to look at an object such as a pencil and the alpha waves persist, one can conclude that there is not enough vision left to distinguish objects or to be of practical value to the patient. On the other hand, if a supposedly blind person is asked to open his eyes and look around and the alpha waves stop, one can conclude that there is enough vision left to distinguish objects at least, and one can with reasonable safety make a diagnosis of malingering or hysterical blindness. Unfortunately a few people do not have an alpha rhythm with the eyes either open or shut. In this case the test cannot be made.

The author concludes that electroencephalography is a reliable objective test for true blindness as opposed to malingering or hysterical blindness.

JOSEPH K. NARAT, M.D.

Livingston, P. C.: The Examination of Night Visual Capacity in Relation to Flying. *Brit. J. Surg.*, 1942, 29: 339.

The author has devised an apparatus for testing night visual capacity under flying conditions. This test enables examination of 6 subjects simultaneously under exactly comparable conditions (72 subjects during the course of a day), and utilizes a number of stimuli so that a wide range is provided for the assessment of results.

The apparatus is used by the Royal Air Force. It consists of a hexagonal metal structure 2 feet high with 4 horizontally placed rectangular apertures in each face or panel. The hexagon can be rotated on a wooden base. The uppermost aperture is used for the detection of malingering. The lower 3 apertures are used for the standard night visual capacity test. The 2 middle apertures are 1 in. apart. Behind each aperture is a white opal screen which can be moved up or down so that the objects etched in black upon it can be altered. All 6 panels may be presented to the subjects by rotating the whole instrument on its base. Because each panel contains 16 objects for analysis 96 combinations are possible. Each of the 2 middle apertures presents 3 letters, set in the normal upright position or directed up, down, or backward. The lowest aperture presents objects such as an aircraft, an arrow, or a cross. The interior of the instrument is illuminated by lamps surrounded by blue filters, so that the 6 sides of each section have the same brightness level for every one of the 6 subjects.

Each subject is seated 1 yard from the instrument in a special chair which supports his back. Through the dark goggles which are worn while the test room

remains lighted, each subject studies a chart illustrating the characters which he will be expected to analyze. He is given a board to which is clamped a Braille type card. A pencil is attached to it. The light in the dark room is then extinguished, the adaptation goggles are removed and passed through a trap door to an assistant who places them upon the next 6 subjects outside the dark room.

During the period of fifteen minutes in complete darkness the technique is explained. The subjects are told that there are 4 tests, each corresponding to a metal button on the boards, and each is exactly similar in technique; the buttons are so placed that they can be felt as 3 in a series followed by a gap and then the fourth button. Each button corresponds to a transverse grooved line upon the Braille card. The buttons are set in the middle of the board, dividing the board into a left and a right Braille line. Each test exposes first objects and then letters. On the left space the names of objects recognized are to be written. If this cannot be done an attempt should be made to copy what is seen. On the right space should be set down what the subjects can detect of the letters. These should be drawn so that the upper group is above the grooved line, and the lower group just below it. If the letters appear obliquely instead of vertically they should be so copied. Each test is exposed for one minute and each test succeeds the next without intermediate pause. On each occasion, the illumination will be slightly increased until the third test is reached. Between this test and the fourth the subjects are exposed to one minute of glare from an electric lamp suspended above the apparatus. They must not look at the lamp but slightly beneath it. Then they receive the final test.

A mark is given for each correct answer. Subjects are graded according to their function as members of air crews, differentiation being made between a night pilot of say a bomber aircraft and an air observer. Observers require a higher degree, pilots a lesser degree, of night vision. It has been found that approximately 3.5 per cent of the personnel score between 30 and 32 marks, while 2.5 per cent score less than 2 marks. Between these two groups comes the main body of subjects, the peak being about 20 marks.

JOSHUA ZUCKERMAN, M.D.

MacNalty, Sir A.: Industrial Eye Injuries. *Brit. M. J.*, 1942, 1: 173.

The industrial worker depends chiefly upon sight for his livelihood. Blindness or impairment of vision, therefore, is the most serious and most costly of all nonfatal accidental risks to the worker, ranking second only to death.

Occupational diseases which affect eyesight can be classified under (a) the results of exposure to heat rays, e.g., glassworkers' and ironworkers' cataract; (b) miners' nystagmus; (c) the toxic effect of certain substances, e.g., lead, derivatives of benzene, carbon bisulfide, and methyl alcohol.

Glassworkers' cataract is posterior-cortical and of slow onset. It is rare. It is apt to affect certain classes of glassworkers exposed to incandescent light. In 1908 a committee of the Royal Society found: (1) that the luminous rays are not the cause of the disease; (2) that ultraviolet radiation is not the cause in so far as any direct action upon the lens of the eye is concerned; (3) that the evidence is strongly in favor of the view that heat is the active agent; (4) that it is uncertain whether the heat radiation acts directly on the substance of the lens, or indirectly by disturbing the nutrition of the lens; and (5) that possibly ultraviolet radiation may play some part in the causation by indirect action on the nutrition of the lens.

Ironworkers are affected by a similar form of cataract.

Nystagmus occurs among those workers who year in and year out subject their eyes to abnormal and unaccustomed movements. Associated symptoms are complaints of objects dancing before the eyes, headaches, dizziness, and general fatigue.

The essential factor in the production of miners' nystagmus was deficient illumination; workers at the coal face are more affected than other underground workers, and the disease may occur with or without the presence of oscillations.

The Bureau of Labor Statistics, United States Department of Labor, gives a list of 52 different poisons used in industrial processes; in at least half of the cases cited it is said that more or less serious injury to the eyes results from continuous handling of the poisons or continuous work in close proximity to them. Workers usually inhale these poisons in the form of vapor, but the inhalation of dust may produce equally harmful effects. Direct action of the poison through or on the skin is another method of entry; and sometimes the poison is admitted through foodstuffs, cigars, cigarettes, or chewing-tobacco handled by the worker with hands from which the poison has not been thoroughly cleansed.

In the United States the following substances are held to be especially productive of serious results to the eyes: ammonia, benzol, and the other intermediates of the dye industry, brass, carbon bisulfide, dimethyl sulfate, hydrofluoric acid, lead, methyl alcohol, methyl bromide, nitroglycerin, and phosphorus. In this country the principal substances that may be implicated are lead, derivatives of benzene, carbon bisulfide, and methyl alcohol. These industrial poisons usually irritate the mucous membranes and give rise to lacrimation and flashes of light before the eyes. Other results may be discoloration of the conjunctiva, disturbances of the visual sense, retrobulbar neuritis, chorioiditis, dilatation of the pupils, photophobia, clouding of the cornea, diplopia from paralysis of the ocular muscles, amblyopia, protrusion of the eyes, contraction of the pupils, ulceration of the orbital bones, shrinking of the eyeballs, erosion of the cornea, transient blindness, progressive atrophy of the optic nerve, and permanent blindness.

A broad classification of occupational accidents is as follows: (1) those occurring in factories; (2) those

occurring in mines and quarries; and (3) those occurring in agricultural and other occupations.

It is encouraging to know that modern methods of prevention have greatly reduced the risk of eye lesions from chemical and other processes and that the results of medical research and progress are promptly applied. Eye accidents in mines, quarries, and factories constitute by far the largest proportion of cases of impaired eyesight or of blindness among industrial workers. Their prevention is largely a question of periodical medical examination, of education, of the use of protective appliances in industry, and of prompt ophthalmic treatment.

LESLIE L. MCCOY, M.D.

Cruthirds, A. E.: Face and Eye Burns. *Indust. M.*, 1942, 11: 109.

The author reported 43 cases of burns of the eye and face treated by the application of a solution of sulfhydryl (hydrosulfosol). Sulfhydryl is a sulfur-containing solution with a -SH linkage that is an active component of glutathione, a compound of great nutritional importance found in almost all human tissues. It was developed by the Institute of Pathology at Western Reserve University.

The burns in this series were due to creosote, lye, and steam. The solution was sprayed on the skin in this area several times until a fine pliable eschar was formed which usually separated on the sixth to eighth day. Four cubic centimeters of the solution were added to 1 oz. of sterile distilled water and used as eye drops for eye burns, or the same solution was used on eye compresses.

Three of the 43 cases were hospitalized because of the severity of the burns. All of the patients recovered in approximately eight days without scars or damage to vision.

The author claims that this solution is valuable for eye and surface burns for the following reasons:

1. There is a prompt alleviation of pain.
2. A flexible eschar forms quickly and separates spontaneously when healing is complete.
3. There is minimum scarring and contracture.
4. Infection is prevented.
5. It is applied easily without the necessity for débridement.
7. Healing takes place more rapidly than with any other method the author had previously used.

HOWARD A. LINDBERG, M.D.

Hughes, W. F., Jr.: Mustard-Gas Injuries to the Eyes. *Arch. Ophth.*, 1942, 27: 582.

The author discusses the incidence, the mechanism of action, and the treatment of mustard-gas injuries of the eyes.

During the first World War from 75 to 90 per cent of all mustard-gas casualties presented some degree of ocular involvement. The eye injuries were divided into 3 groups:

1. About 75 per cent of the cases presented only mild irritation of the conjunctiva. This condition usually subsided in one or two weeks.
2. About 15 per cent of the cases presented severe involvement of the conjunctiva. These cases usually revealed a horizontal white band of chemotic conjunctiva between the eyelids, and diminished or absent sensation of the cornea. The surface of the cornea was roughened but did not stain. Recovery usually occurred within four or five weeks.
3. About 10 per cent of the cases presented erosion of the cornea. These cases usually required a convalescence of two or three months.

The extent of the damage to the cornea depends upon the concentration of the vapor and the length of exposure to it. The eyes react to as little as 1 part in 10,000,000 for one hour—a much lower concentration of vapor than that to which the skin reacts.

The injured cornea may appear in any of the following stages: (a) immediate damage to the epithelium of the cornea associated with clouding and necrosis of the stroma; (b) infiltration at the limbus and in the stroma of the cornea, which usually appears after a period of five hours; (c) clearing of the opacity, which occurs after a period of from five to seven days; (d) progressive vascularization of the cornea; or (e) persistent ulceration of the cornea which may last weeks or may recur after being latent for a period of years.

A number of theories have been developed to explain the mechanism of action of mustard gas on human tissues. These theories are divided into two main groups:

1. The local-action theories, which attribute the damage to liberation of hydrochloric acid, to the direct combination of mustard with the tissue proteins, to the oxidative derivative of mustard, or to the hypersensitivity of tissues previously injured by mustard.
2. The systemic-action theories, which attribute the damage to decomposition products, disturbances of metabolism, bone-marrow necrosis, inhibition of antibody formation, or to symptoms of shock secondary to burns.

Prophylaxis is important. As soon as a faint transitory odor of mustard or of garlic is detected, the gas mask should be adjusted immediately to prevent injury to the eyes or to the respiratory tract. Liquid mustard cannot penetrate glass.

In mild cases, treatment consists of immediately separating the eyelids to overcome the patient's fear that he has lost his vision; immediate and frequent irrigations of each eye even several hours after exposure, with a solution of physiological saline solution, of 2 per cent boric acid, of 1 or 2 per cent bicarbonate of soda or of dichloramine-T in chlorinated paraffin, and the use of atropine solution or ointment routinely in all cases in which the cornea is affected.

In severe cases, but not before twenty-four hours have elapsed after exposure, any of the following may be used: liquid paraffin, acriflavine in castor oil (1:15,000), or cod-liver oil with sodium bicarbonate and dextrose. Dark glasses should be worn. A solution of 10 per cent mild silver protein should be

instilled twice a day and washed out with a solution of 2 per cent boric acid.

A serious mustard burn of the cornea may require two or three months' convalescence, during which time a solution of 0.25 per cent zinc sulfate with epinephrine should be instilled daily. Permanent blindness rarely occurs but vision may be reduced by irregular astigmatism or opacities of the cornea.

JOSHUA ZUCKERMAN, M.D.

Irvine, R., Irvine, A. R., and Irvine, M. D.: The Aqueous Humor in Relation to Uveitis. *Am. J. Ophth.*, 1942, 25: 150.

An etiological diagnosis of uveitis cannot be made from the clinical appearance of the eye, and the author has attempted to study the aqueous as a means of making a more complete diagnosis. This report deals with a total of 44 cases of uveitis together with a report on the findings in experimentally produced sclerokeratitis in rabbits.

The aqueous was aspirated and various chemical determinations were made on all of the patients. The following relationships were observed:

1. The sugar content of the aqueous varied primarily with the blood sugar level. It could not be correlated with the etiology of the pathological process but tended to be lower in acute inflammation.

2. The ratio of aqueous to serum chloride averaged 1:21, approximately that for cerebrospinal fluid to serum chloride, and was not altered in glaucoma.

3. The cell content was affected primarily by the acuteness and intensity of the inflammation and not by the etiology.

4. A high percentage of polymorphonuclear cells was usually associated with high protein content of the aqueous, which had a tendency to clot. This type of aqueous was characteristic of inflammation of the anterior uveal tract.

5. An increase in protein content of the aqueous was associated with synechiae and varied with the length of time the protein had been increased and probably with the percentage of fibrinogen.

A great deal of data is presented in table form and, although it represents a great deal of work, the findings are too limited to draw final conclusions.

IRVING PUNTENNEY, M.D.

Cordes, F. C., and Hogan, M. J.: Dysostosis Multiplex (Hurler's Disease; Lipochondrodysplasia; Gargoylism); Report of the Ocular Findings in 5 Cases, with a Review of the Literature. *Arch. Ophth.*, Chic., 1942, 27: 637.

Dysostosis multiplex, first recognized as a clinical entity by Hurler in 1919, is a rare congenital disease characterized by dwarfism with scaphocephalic deformities of the skull and chondrodystrophic changes in other parts of the body. The usual age at onset is about one year. In addition to the bony changes there is a disturbance of the storage of lipids, the exact nature of which is not thoroughly understood. Only about 50 cases are recorded in the literature.

The usual findings are: a large head, saddle nose with flaring nares, large alveolar processes, thick and fleshy tongue, a short neck, kyphotic spine, and protuberant belly with umbilical hernia. The liver and spleen are enlarged. The limbs are short, with limitation of motion in the joints. There are ocular defects in 75 per cent of the cases. These consist of wide separation of the orbits, prominence of the globes, and bilateral corneal clouding. The corneal pathology has been observed under the slit lamp and is noted to consist of a diffuse infiltration of small punctate dots in the stroma, varying in size and yellowish-gray in color. The corneal infiltrates have been identified as lipid deposits.

The corneal complications may lead to an erroneous diagnosis of interstitial keratitis and 1 of the authors' cases had been treated for lues in spite of negative serological and spinal-fluid findings. Careful examination of the corneas, together with the general findings which suggest the term "gargoylism," should make the differential diagnosis not too difficult.

The prognosis in this disease is unfavorable; in most cases death occurs from heart failure or disease of the respiratory tract before the age of twenty.

Other diseases mentioned by the authors as being characterized by disturbances in the storage of lipids include: Niemann-Pick disease, Hand-Schuller-Christian disease, Gaucher's disease, and Tay-Sachs disease.

The 5 cases reported in this article occurred in 3 families. Two of the patients from different families were twins, the other twin in each case not being affected with the disease. In all 5 cases both corneas were involved. Slit-lamp examination was employed in 4 cases and the typical findings described were noted.

WILLIAM A. MANN, M.D.

Calhoun, F. P., Jr., and Reese, A. B.: Rhabdomyosarcoma of the Orbit. *Arch. Ophth.*, 1942, 27: 558.

Calhoun and Reese review 14 cases of rhabdomyosarcoma of the orbit collected from the literature, report 5 cases, and summarize the histological and clinical characteristics of this type of tumor.

According to general pathologists, malignant tumors of definite myogenic origin may arise in any part of the body in which striated muscle exists. These tumors are known as rhabdomyomas, myoblastomas, malignant rhabdomyoblastomas, malignant myomas, and rhabdomyosarcomas, and are characterized histologically by polymorphism of the tumor cells, giant cells, spindle cells resembling muscle cells, and the presence of cross-striated fibrils in their cytoplasm. A rhabdomyosarcoma which reveals little differentiation of its cells grows rapidly and results in death from generalized blood-stream metastases within one year or less. One in which the cells are more differentiated usually grows relatively slowly but recurs after local excision and is followed by metastasis, but not to the regional lymph nodes. There is a special type of rhabdomyosarcoma which metastasizes not only through the blood stream but

also to the regional lymph nodes. This type occurs in the testis, bladder, prostate, vagina, and palate of children.

Rhabdomyosarcoma usually situated at the upper inner part of the orbit may arise from the extraocular muscles or the muscles of the eyelids. It occurs most frequently in males six or seven years of age. (In this series there were 12 males and 5 females of this age.) The tumor grows rapidly. In 5 cases death occurred within one and a half years after the appearance of the tumor. Growth of the tumor was arrested in only 1 case. In this case there was no recurrence two and one-half years after exenteration.

The 5 cases reported by the authors were irradiated before exenteration of the orbit. Radiation was ineffective except in 1 case in which there was temporary regression for fifteen months. Two of the 5 patients are alive and well and reveal no recurrence two years after exenteration of the orbit and three years after the first appearance of the tumor. One child reveals no signs of recurrence one month after exenteration of the orbit. In 1 patient after enucleation of one eye and intensive irradiation of the other, seven years previously, for the treatment of bilateral retinoblastoma, a rhabdomyosarcoma developed behind the remaining eye. It is believed that the rhabdomyosarcoma was induced by the irradiation.

Calhoun and Reese conclude that the apparent arrest of the growth in 2 of the 5 cases suggests that this type of sarcoma of the orbit has a more favorable prognosis than that generally assumed for sarcoma of the orbit in general.

JOSHUA ZUCKERMAN, M.D.

EAR

Merica, F. W.: Vertigo Due to Obstruction of the Eustachian Tubes. *J. Am. M. Ass.*, 1942, 118: 1282.

Vertigo caused by obstruction of the eustachian tube is a distinct clinical entity which is often overlooked. An experience in the treatment of 135 cases of this type has convinced Merica that distressing symptoms of vertigo, nausea, and vomiting, sometimes present for long periods, can be relieved by mechanical inflation of the eustachian tubes. Since obstruction of the eustachian tube is one of the most obvious and also the most easily corrected causes of vertigo, every patient with dizziness and nausea should be subjected to the therapeutic test of inflation of the tubes as a first step in a thorough clinical investigation.

In this series approximately two-thirds of the patients were women. Approximately half were between forty and sixty years of age. The obstruction of the eustachian tubes was associated with acute or chronic inflammation of the nasal sinuses or ears in a large proportion of cases. The duration of the symptoms varied from a day or two to several years.

The symptoms may be of sudden onset or the condition of vertigo may develop gradually and intermittently. In the latter type the true cause of the difficulty is often overlooked and the patients are subjected to a variety of treatments for supposed disorders of the digestive system which yield no benefit.

Some patients are relieved permanently by only one or two inflations of the eustachian tubes; in other cases the symptoms recur and may again be relieved by re-establishment of the patency of the eustachian tubes. In addition to the mechanical procedure of inflation, proper treatment of these patients demands attention to chronic sinus infections and chronic tonsillitis, to possible allergic factors and irritants, such as tobacco, and an investigation of the basal metabolic rate.

The vertigo is caused in most instances, and perhaps in all, by unilateral eustachian obstruction or by more complete obstruction on one side than the other. The direction of the gait furnishes a clue to the side which may be affected, for in most of the cases the staggering is in the direction of the obstructed side.

NOAH D. FABRICANT, M.D.

Tamari, M.: Histopathological Changes of the Temporal Bone in Paget's Disease. *Ann. Otol. Rhinol.*, 1942, 51: 170.

Tamari reports 3 cases of Paget's disease of the temporal bone, which appear to reveal new facts because of the peculiar extension of the pathological process. It has been repeatedly pointed out that the most important changes in Paget's disease first originate in the marrow cavities.

In all of the author's cases the bony changes commenced in areas well supplied with marrow tissue: in the tubal region, in the tegmental and hypotympanic plates, and in the spongy bone of the pyramid and mastoid. The periosteal layer showed a complete reconstruction. The middle enchondral layer resists the rebuilding power only for a time, and eventually invasion of new bone from the outside occurs. The perforating vessels of the labyrinthine layers and their perivascular sheaths are the earliest carriers for bony rebuilding. In the inner layers the disease becomes in reality a deformity. At first the deformations are microscopic, but later they can be seen in some sections with the naked eye. Small fissures with a few indefinite tissue remnants can be found at the arcuate contacts of both the newly rebuilt bone and the old bone. Finally, the newly substituted bone of the labyrinth becomes lamellar and of a very dense character. Certain clinical inferences are drawn from these findings.

NOAH D. FABRICANT, M.D.

Guerry, D., III, and Putney, F. J.: The Local Use of Sulfathiazole in the Management of Simple Mastoidectomy Wounds. *Arch. Otolaryngol.*, 1942, 35: 399.

Sulfathiazole was employed locally after simple mastoidectomy in 20 unselected cases, while in 20 other unselected cases serving as controls the wound was treated in a similar fashion except for the omission of sulfathiazole. In the series of cases in which

chemotherapy was used the drainage period averaged sixteen and seven-tenths days, or 52.8 per cent less than in the control series, while postoperative hospitalization was reduced an average of eleven and four-tenths days, or 55 per cent. Reports of cases illustrating the value of sulfathiazole used locally in simple mastoidectomy wounds are included in this article, as are reports of 2 cases in which complications occurred following sulfathiazole treatment.

Guerry and Putney believe that healing is promoted with minimum suppuration by the use of sulfathiazole in simple mastoidectomy wounds.

NOAH D. FABRICANT, M.D.

NOSE AND SINUSES

Waldron, C. W.: Injuries to the Nose. *Minnesota Med.*, 1942, 25: 258.

The immediate treatment of the injured nose should be directed toward the control of hemorrhage and the prevention of shock. Cleanliness should be observed; lacerated and contused skin margins may require conservative débridement, but partially separated fragments of bone and cartilage should not be removed. Wound suturing should be undertaken with a due sense of responsibility regarding the ultimate scar and contour of the nose. Subcuticular sutures, such as Deknatal B or fine horse hair, are preferable and leave no stitch marks.

Primary treatment of fractures of the nose may be undertaken within the first two or three weeks after injury, i.e., before more or less fibrous immobilization has taken place. Generally speaking, unilateral medial depressions and lateral deviations of the bridge are corrected under local anesthesia with a combined external finger manipulation and intranasal elevation of the parts with a slightly curved blunt elevator. A slight overcorrection is often advisable and the fragments are held in place by intranasal packing of ½ in. well lubricated iodoform gauze. This should be changed daily until the displaced fragments or septum are held in the mid-line. Often an external splint made of dental wax or soft metals will have to be applied and held in place by adhesive tape, or in some cases one must use the Joseph or Safian nasal brace or head bands with adjustable arms.

Fracture dislocations of the nasal septum may frequently be mobilized and manipulated to a reasonably satisfactory midline position. Submucous resection of the nasal septum may, however, be necessary at a later date to relieve nasal obstruction.

JOHN F. DELPH, M.D.

Lindsay, J. R.: Nonsecreting Cysts of the Maxillary-Sinus Mucosa. *Laryngoscope*, 1942, 52: 84.

Clinical observations have demonstrated beyond doubt that the nonsecreting cysts of the antrum are capable of producing a variety of symptoms. These include fatigue, irritability, headaches, low-grade fever, mild dizziness, and pain in the joints. Local symptoms of sinus disease may be present or absent. This type of cyst may constitute a focus in infectious arthritis. Nonsecreting cysts are frequent in the maxillary sinus. X-ray examination is necessary to determine their presence.

The cyst fluid is usually sterile on ordinary culture methods. This does not rule out the possible role of bacteria in the development of the cyst, nor is it necessarily evidence against toxicity. (Tuberculous pleural effusion and some empyemas have been found sterile, according to Schade.) Chemical analyses show that the cyst fluid must be classed as an exudate. This fact suggests that these cysts are not caused by allergic reaction in the mucosa, since in all allergic reactions the resulting edema is a transudate and reversible.

For the production of the cyst fluid, damage to the capillary walls by bacterial toxins, anoxemia, or other noxious influences appears to be necessary. The probable explanation is, therefore, that the cyst originates during an infection and that the formation is due in the first place to the action of bacterial toxins on capillary permeability. The nature of the reaction, whether due to toxins, foreign protein, or other factors, which accounts for the clinical symptoms has not yet been determined. Further investigation is being carried out.

NOAH D. FABRICANT, M.D.

MOUTH

Hellman, M.: The Optimum Time for Orthodontic Treatment. *J. Am. Dental Ass.*, 1942, 29: 622.

In discussing the time for orthodontic treatment the author emphasizes the fact that the goal is to establish normal occlusion, not temporarily, but permanently. This permanence cannot be achieved until the permanent teeth are erupted, and he doubts the benefits of early treatment of malocclusion.

If correction of malocclusion is begun early, at four, five, or six years of age, it will be necessary for the patient to wear orthodontic appliances until the secondary molar erupts at twelve years. This long period with appliances attached to the teeth subjects them to some hazards and is not economical. The most favorable time to gain the desired orthodontic result is the period of maximum facial growth.

CHARLES W. FREEMAN, D.D.S.

Budnitz, E., Nizel, A., and Berg, L.: Prophylactic Use of Sulfapyridine in Patients Susceptible to Subacute Bacterial Endocarditis Following Dental Surgical Procedures. *J. Am. Dental Ass.*, 1942, 29: 346.

While the results of the use of sulfonamides in subacute bacterial endocarditis have been disappointing, the author suggests a prophylactic rather than a curative role for sulfapyridine following dental surgical procedures in patients who may be susceptible.

Transient streptococcus bacteriemia following the removal of teeth has been demonstrated, and while this has little or no effect on persons in good health, if a cardiac defect exists the soil is fertile and a sub-

acute bacterial endocarditis may result. Dental surgical procedures have been found to precede the development of this condition in more than 10 per cent of a series of cases.

In the prophylactic use of sulfapyridine for patients with congenital or valvular disease of the heart requiring tooth extraction, the drug was administered (0.5 gm.) every four hours for three or four days before operation, and the same number of succeeding days. In 27 recorded cases no postoperative blood culture was positive, and no untoward reaction occurred. None of these patients developed bacterial endocarditis. CHARLES W. FREEMAN, D.D.S.

Burket, L. W., and Hickman, G. C.: Oral Herpes (Simplex) Manifestations; Treatment with Vitamin B Complex. *J. Am. Dental Ass.*, 1942, 29: 411.

Local irritations and infections often appear to be the cause of herpes labialis, canker sores, and aphthous stomatitis, but it is generally believed that the exciting cause is a virus. Typical lesions have been produced experimentally by inoculation with the vesicular fluid, and the virus recovered from the experimentally produced vesicles: There is little evidence to support the allergic theory of etiology or that of a relationship to focal infection.

Oral herpes and aphthous stomatitis have been treated locally by silver nitrate, zinc chloride, camphor, and alum. Autogenous serum, small-pox vaccination, neoarsphenamine, and sulfanilamide therapy have also been used.

The therapeutic use of Vitamin B complex was studied in 13 cases. Six cases of acute habitual aphthae treated with Vitamin B complex are reported as showing definitely favorable results both as to the therapeutic response and the prevention of recurrent lesions. Herpetic lesions are not considered a specific symptom of B complex deficiency, and it is more likely that, through its effect on cellular metabolism the Vitamin B complex prevents recurrence and promotes recovery of the developing lesions.

CHARLES W. FREEMAN, D.D.S.

Vívoli, D., Gallo, A., Pozzo, J. J., and D'Amato, W.: Tuberculosis of the Salivary Glands (Tuberculosis de las glandulas salivales). *Arch. Soc. argent. de anat. normal y patol.*, 1941, 3: 195.

The salivary glands are among the organs most resistant to tuberculosis. It has been claimed that this is because they are very alkaline in reaction and the tubercle bacillus thrives best in an acid medium. The authors think, however, that there are other factors involved, such as the bacteriolytic ferments and the antitoxic products elaborated in them. Tuberculosis of these glands may be primary or secondary; the former type is generally benign in its course and the latter malignant.

Two cases are described, the first in a woman of fifty-five years who for about two years had had a painless swelling in the right parotid region. There was also an enlarged gland in the neck. She was in good general condition. Thirty years before she had had a similar tumor removed on the left side. The parotid and the enlarged gland were removed and showed caseation in the center. Examination of the tissue for Koch's bacilli was found to be positive. This was evidently a primary and mild form of the disease.

The second patient was a man of forty-two years who entered the hospital in a very bad general condition; he was cachectic and had a temperature of 38 degrees. There was a large swelling in the right parotid region. He had Pott's disease, and examination showed tuberculosis of the lungs and multiple bone foci. He died shortly afterward. Autopsy showed diffuse caseous tuberculosis of the right parotid gland and nodular tuberculosis of the left parotid gland, and tuberculosis of both submaxillary glands with fistulas. This was a case of the malignant secondary form of the disease.

AUDREY G. MORGAN, M.D.

PHARYNX

Panneton, P.: Tonsillectomy in Young Children (L'amygdalectomie chez les petits enfants.) *Union méd. du Canada*, 1942, 71: 239.

The two main objections usually advanced against tonsillectomy in children of less than five years of age are that (1) a satisfactory tonsillectomy in these children is technically very difficult and (2) the results of this operation are not justifiable in children of less than three years.

Panneton believes that both of these objections are undeserved.

Since 1935 he has performed tonsillectomies in 105 children. Two of this group were five years old, all the rest were younger. Three were less than one one year old, 30 from one to two years, 54 from two to three years, 10 from three to four years, and 6 four or five years old.

The average age of the first 20 children was eighteen and one-half months. The last 20 averaged thirty-four and one-half months. This expresses a change in the children's general health rather than an alteration of the surgeon's judgment as to the more appropriate age for tonsillectomy. About one-third of the group were children in impaired general condition. Gross hypertrophic tonsillitis was rather rare. There was no death, no hemorrhage, and no other complication. About three-quarters of the children had mainly nasal symptoms. Eighty-two per cent of them recovered completely following tonsillectomy, and 8 per cent were benefited. Twenty-five children were operated upon for refractory otitis, and half of them were completely relieved. Seventy-eight children had chronic or subacute sore throat. The incidence of this disease was greatly reduced two months after operation, but too little time has elapsed to permit definite conclusions as to this point.

Two children were operated upon during an attack of acute tonsillitis. One child experienced high

postoperative fever, the other not. Both of them finally recovered.

Two months after operation remnants of the tonsils were found in only 4 children, and they were quite small. The author concedes, however, that these remnants may grow and that others might show up later in other children. HEINRICH LAMM, M.D.

NECK

Frantz, V. K., Forsythe, R., Hanford, J. M., and Rogers, W. M.: Lateral Aberrant Thyroids. *Ann. Surg.*, 1942, 115: 161.

The authors report on 30 cases of lateral aberrant thyroid. Of these 30, 27 were tumorous, 23 of the 27 were malignant, and of these 23, 8 (34 per cent) died.

The lateral aberrant thyroids derive from the ultimibranchial bodies, at least in the large majority of instances. They are usually located below the level of the twelfth nerve. Nearly all nodules lie behind the sternocleidomastoid muscle. They tend to occupy the same general location as a chain of deep lymph glands, usually from the posterior belly of the digastric muscle to the clavicle. The upper and midcervical nodes adhere usually to the adjacent veins and muscles, the lower ones, however, are loose in the areolar tissue. If the thyroid is involved with associated nodules these lie usually behind the upper part of one lobe. Thus the three dominant sites are (1) the upper deep cervical region; (2) the lower deep cervical region, and (3) the supraclavicular region.

There is no proof of function of the lateral aberrant thyroids. The removal of lateral aberrant thyroid tissue alone in cases of hyperthyroidism never reduced toxicity, nor did removal of such tissue ever cause myxedema. In malignant degeneration these nodules never mestastasise; at least such mestastasis to the lymph glands is very hard to prove.

In the differential diagnosis, chronic lymphadenitis, tuberculous lymphadenitis, Hodgkin's disease, lymphosarcoma, and metastatic carcinoma are to be considered. The 30 cases were classified as 7 benign and 23 malignant ones; of the latter 12 were papillary carcinoma, 2 were combinations of malignant adenoma and a papillary arrangement, 3 malignant adenomas without papillary arrangement, and 6 were adenocarcinomas.

All lateral aberrant thyroids should be considered as potentially malignant. There is not enough evidence to evaluate the effect of roentgenotherapy. In 2 cases it apparently arrested the disease, in 2 others 2 recurrences occurred while x-ray treatment was being administered. FRED S. MODERN, M.D.

Woodward, F. D.: Complete Cicatricial Stenosis of the Esophagus; Permeation Made Possible by External Operation in Certain Cases. *Ann. Otol., Rhinol. & Laryngol.*, 1942, 51: 94.

Woodward states that external exposure of the esophagus is advocated as a safe surgical procedure for the permeation of complete esophageal strictures, in selected cases, when other methods have failed. JAMES C. BRASWELL, M.D.

SURGERY OF THE NERVOUS SYSTEM

BRAIN AND ITS COVERINGS; CRANIAL NERVES

Hutchison, K.: Acute Otitic Meningitis. Chemotherapy Advances. *Canadian M. Ass., J.*, 1942, 46: 261.

The clinical picture of fulminating meningitis following acute suppurative otitis media is well known, but the change from 100 per cent fatalities to 85 per cent recoveries deserves attention. Credit is given to the neurologists and neurosurgeons at the Montreal Neurological Institute for help in bringing to pass the full surgical drainage of the original source of infection. The report concerns 29 cases treated in the Royal Victoria Hospital, Montreal, and in the Montreal Neurological Institute.

All patients were regarded as having acute mastoid infections and 26 simple mastoid operations were performed in the group of 29. A cerebellar abscess was drained in one case. The streptococcus hemolyticus beta was the predominant organism and was present in 17 cases (58.6 per cent); the pneumococcus Type III was found in 7 (21.4 per cent); the pneumococcus Type IV in 2; the pneumococcus Type 32 in 1 case; and the pneumococcus Type II in 1. One infecting agent was not known until autopsy, when the examination revealed it to be the pneumococcus Type III.

A few selected case reports are given and there is a table summarizing the clinical course, bacteriology, and treatment of all of the cases.

Of the 29 patients, 8 recovered, and all of these had had meningitis due to the streptococcus hemolyticus beta. The use of soluble dagenan is stressed, as the drug can be better controlled in this form. The addition of nicotinic acid when the drug is given orally reduces the vomiting and the toxic manifestations. Chemotherapy was discontinued if the white count fell below 6,000, but a satisfactory blood level was considered to be from 6 to 8 mgm. per cent. Fluids were forced and frequent lumbar puncture was resorted to. The importance of early bacteriological diagnosis is emphasized.

ADRIEN VERBRUGGHEN, M.D.

PERIPHERAL NERVES

Reichert, F. L.: Compression of the Brachial Plexus. *J. Am. M. Ass.*, 1942, 118: 294.

Compression of the brachial plexus is a brachial neuritis, with or without vasomotor or vascular disturbances in the upper extremity, which appears in certain persons because of an abnormal development of the shoulder girdle or of the brachial plexus, factors that permit friction or pressure on the brachial plexus and the subclavian artery. This friction or pressure, with the resultant irritation of some of the fibers that supply the scalenus muscles produces contractions and spasm of the scalenus anticus and scalenus medius muscles in particular, so that an abnormal elevation of the first rib occurs. This elevation in turn increases the angle between the lateral border of the scalenus anticus muscle and the first rib, which squeezes the lower trunks of the brachial plexus and the subclavian artery and also the plexus between the posterior lateral border of the scalenus anticus muscle and the body of the scalenus medius muscle. Thus a vicious circle exists which is relieved when the anterior scalenus muscle is sectioned or when corrective posture is maintained day and night to overcome irritation of the plexus and spasm of the scalenus muscles. Trauma to the shoulder region or excessive strain on the shoulder and the supraclavicular region, such as that incurred by hod carriers and soldiers, may be the exciting cause of symptoms.

Pain, tingling, and numbness occur in practically all cases of compression of the brachial plexus. They may extend from the cervical, scapular, or pectoral regions to the hand and fingers. Slight muscular weakness may be found, but atrophy and severe circulatory changes, such as cyanosis, coldness, or gangrene of the fingers, are infrequent. The symptoms are mainly sensory and sympathetic, with the pain of a dull, gnawing, or burning character, and are affected by posture and work. Sleep is disturbed by the pain, and sedatives give slight relief. The irritation may be limited to the upper portion of the brachial plexus, with pain and paresthesia radiating up the posterior part of the neck and the occipital region and downward over the shoulder to the scapular region. It may involve the pectoral region and the inner side of the arm and forearm, simulating anginal pain. Frequently the pain is limited to the distal half of an upper extremity, affecting the elbow, hand, and middle fingers. Paresthesias and sensory disturbances may be bizarre in outline because of the involvement of sympathetic fibers.

The diagnosis of compression of the brachial plexus is made when local tenderness is found and the symptoms are reproduced by shifting the digital pressure vertically along the scalenus muscle over the width of the brachial plexus.

Pulling or pressing the affected shoulder downward, bending the head and neck to the opposite shoulder, turning the head to look over the affected or the opposite shoulder, pressing the affected arm against the chest with the shoulder depressed, and throwing the shoulders and head back are other methods of aggravating the complaints and confirming the diagnosis.

During examination relief of symptoms usually follows shrugging of the affected shoulder, shrugging the shoulders and bending the head and neck forward, and bending the head and neck to the affected side.

Treatment is operative and conservative. Conservative or nonoperative treatment was sufficient to bring relief from symptoms to 60 patients. The nonsurgical management consists of variations of the following regimen, and depends on the severity of the symptoms: (1) elevation of the shoulder by a sling or by holding the hand across the chest in a fold of the buttoned shirt or coat, (2) elimination of the type of work that aggravated the symptoms, and (3) a change in sleeping habits. Since two-thirds of the 74 patients complained that their symptoms were worse or at least severe during the night, patients were instructed to sleep on three pillows. Most patients were accustomed to sleep either without a pillow or with one pillow, a few slept on their abdomens and only 2 had learned that sleeping with the affected arm over the head gave relief.

Experience had shown that relaxation of the scalenus muscles and obliteration of the squeezing mechanism was obtained by using three pillows so arranged that when the patient was lying on the back, the shoulders, head and neck were forced forward (Fig. 1). When the patient lay on the side, with the shoulder on the mattress between the two under pillows and the head on the third or top pillow, there was no sinking of the head toward the under shoulder. If the good shoulder was down, a fourth pillow, under the affected elbow and forearm, would help in keeping the affected shoulder elevated. If the patients were awakened by pain they invariably found either that they had slipped off the pillows, or that the pillows had become disarranged. No sedatives were given, since too long an interval would elapse under sedation before the pain produced by the bad position on the pillows or by disarrangement of the pillows would finally awaken the patient. Although sleeping with the arms over the head relaxes the squeezing mechanism, it was found that this position was rarely maintained throughout the night.

When conservative treatment fails, division of the scalenus anticus muscle close to its insertion onto the first rib is indicated. DAVID J. IMPASTATO, M.D.

Pusanov, S. M.: New Contributions to the Morphology of the Nerve Scar (Neues zur Morphologie der Nervennarbe). *Arch. biol. Nauk*, 1940, 60: 114.

If a functioning nerve is severed centrally to a nerve scar and split into various bundles, upon stimulation of the individual bundles there is always a similar or total effect upon the muscle, irrespective of how many axis cylinders are in the individual bundle. However, if the same stimulation is given distal to the scar then the effect on the muscle is proportional to the number of axis cylinders in the bundle. Apparently, therefore, the scar contains some (Nivelle) fiber formation which acts in the nature of a synapse.

The author examined scars in the different stages of development and found that the Nivelle phenomenon disappears at the moment when the new axis cylinders develop a medullary sheath. The first regenerated axis cylinders lie naked in the sheath of Schwann, which shows rich anastomoses, and are gathered into bundles. About the tenth month the axis cylinders isolate themselves by formation of the myelin sheath and a splitting-up of the bundles into individual fibers occurs.

According to this the Nivelle phenomenon is due to an apposed induction of the myelin-lacking axis cylinder. This phenomenon can be observed also ontogenetically, i.e., on newborn rats, in which the transition from the one reaction type to the permanent type occurs very rapidly—during the first twenty-four hours of life.

(SPONHOLZ). L. A. JUHNKE, M.D.

SYMPATHETIC NERVES

DeTakats, G., Heyer, H. E., and Keeton, R. W.: The Surgical Approach to Hypertension. *J. Am. M. Ass.*, 1942, 118: 501.

In the surgical approach to hypertension the authors have made use of the following operations:

Supradiaphragmatic splanchnic-nerve section. In this operation the splanchnic nerves are interrupted above the diaphragm and the ninth to the twelfth sympathetic ganglions are excised.

Infradiaphragmatic splanchnic-nerve section. The splanchnic nerves are severed below the diaphragm, together with a small slice of the celiac plexus. In addition, the first and second lumbar ganglions are removed.

Transdiaphragmatic splanchnic-nerve section. This operation is a complete resection of the major splanchnic nerve, removing it from the fifth dorsal root down to its entrance into the celiac ganglion. In addition the sympathetic ganglionated trunk is removed from the ninth dorsal root to below the first or occasionally the second lumbar ganglion. In order to obtain this exposure, the diaphragm must be incised and sutured. Through this approach, the renal artery, pelvis, ureter, renal parenchyma, and adrenal glands may be inspected and palpated. The operation has been described by Reginald Smithwick.

Omental or muscular graft into the kidney. After decapsulation and scarification of the kidney, a 1 in. (2.5 cm.) deep incision is made along the whole convexity of the kidney and an omental flap or a pedicled muscle flap is sutured into the incision. This operation is intended to increase the vascular supply and also to revascularize the kidney. The exact indications for the vascular graft are not yet clear. The authors believe that in cases of late atrophic pyelonephritis or of Grade 3 essential hypertension, when splanchnic nerve section alone cannot bring about adequate revascularization of the kidney, this operation might be added to insure a maximal blood supply.

Nephrectomy. This is done for unilateral renal disease associated with hypertension when there is no detectable impairment of function in the opposite kidney.

TABLE 1. SAMPLE FORM FOR PREOPERATIVE STUDY OF HYPERTENSIVE PATIENTS

Name: E. L. Age: 26 Sex: Male Race: White

Present complaint: high blood pressure for 3 weeks (found during physical examination); no symptoms

History: no history of nephritis, facial or ankle edema or hematuria; scarlet fever 1931; no familial incidence of hypertension

Vascular Reactivity

12 hour blood pressures (during bed rest):

7 a.m. 180/134	1 p.m. 180/124
8 a.m. 170/112	2 p.m. 178/120
9 a.m. 190/120	3 p.m. 190/110
10 a.m. 184/118	4 p.m. 180/120
11 a.m. 170/110	5 p.m. 190/122
12 noon 170/112	6 p.m. 190/120
	7 p.m. 188/118

Sodium amytal (oral dose), 0.6 gm. (bed rest):
Lowest blood pressure before, 178/124
Lowest blood pressure after, 130/98

Pentothal sodium (intravenous dose) 2 gm.:
Lowest blood pressure before, 175/120
Lowest blood pressure after, 130/90

Sodium nitrite (oral) dose ½ grain (0.03 gm.) hourly for 6 doses:
Lowest blood pressure before, 230/135
Lowest blood pressure after, 180/118

Cold stimulus (method of Hines):
Lowest blood pressure before, 180/118
Highest blood pressure after, 208/132
Systolic elevation, 28 mm.
Diastolic elevation, 14 mm.
Time to return, 4 minutes

Renal Function

Urea clearance, 45.7 cc. per minute
Phenolsulfonphthalein return (15 minutes), 30 per cent
Concentration test (Lashmet-Newburgh):

	Specific gravity	Volume
Specimen 1	1.029	690 cc.
Specimen 2	1.031	50 cc.
Specimen 3	1.031	20 cc.

Glomerular filtration rate, 120.4 cc. per minute

Total renal blood flow, 670 cc. per minute

Urinary content of albumin, 0 mg. per 100 cc.

Microscopic study of urine:
Casts per high power field, 0
Red blood cells per high power field, 0
White blood cells per high power field, 0

Heart size:
Cardiothoracic index, 0.5

Electrocardiogram:
(1) Sinus arrhythmia
(2) Small Q_3 and Q_3 present
(3) T_1 low, flat
(4) T_2 low, diaphasic
(5) P_2 high, sharp

Fundoscopic Examination:
Photographs of the fundi taken 10/15/40; there is some spasm of retinal arterioles, with slight sclerosis but no exudate or papilledema

Spinal Fluid Pressure, — mm.

Pyelogram, normal

Comment: hypertensive cardiovascular renal disease of Grade 2; good renal function and good fall in blood pressure with sedation

Renal biopsy. A small slice (1.5 cm. long and 3 mm. thick) of renal cortex is removed during the transdiaphragmatic and infradiaphragmatic sympathectomies and when the renal grafts are made.

Before operation the patients are thoroughly studied (Table 1) and classified as to the severity of the hypertension (Table 2). The best results were obtained in the mild, moderate, and late benign grades of hypertension, whereas very poor results were obtained in the malignant type.

SMITHWICK states in the discussion that he obtains fairly good results in the malignant group.

TABLE 2. THE GRADING OF ESSENTIAL HYPERTENSION*

	Early or Mild, Grade 1	Moderate, Grade 2	Late Benign, Grade 3	Malignant, Grade 4
Age	30 to 65	21 to 55	22 to 57	8 to 58
Symptoms	Early morning headaches, vertigo or no symptoms	No symptoms or early morning headaches, vertigo	Nervousness, headache, vertigo, nycturia, dyspnea on exertion	Nervousness, visual disturbance, severe headaches, muscle pains
Retinal changes	Minimal narrowing of arterioles or no changes	Arteriovenous compression, moderate sclerosis of arterioles	Recurrent angiospasm, arteriolar sclerosis; hemorrhages, exudates; no papilledema	As in grade 3; plus papilledema
Blood pressure	Systolic pressure 200 to 150; diastolic 120 to 100; occasionally normal at rest	Systolic 250 to 170; diastolic 130 to 100; lower at rest but never normal	Almost always over 170/110; fluctuates upward	Diastolic very high; fixed blood pressure
Heart	Minimal if any changes	Slight enlargement, left ventricular preponderance, good function	Enlarged; actual or impending congestive failure; sometimes angina	Congestive or anginal failure often present
Urine	Normal	No change or mild albuminuria and casts	Contains albumin, casts, often red cells	Albumin, casts, red cells
Renal function	All tests show normal function; urea clearance may be slightly decreased	Slight decrease; urea clearance 30 to 40 cc.	Impaired function; urea clearance 20 to 30 cc.	Poor function; urea clearance 7 to 20 cc.
Brain	.....	.....	Cerebral accidents occur	Cerebral accidents
Five year mortality, percentage	30	46	80	99

*Our data combined with those of Wagener and Keith and Palmer and Smithwick.

The mechanism of the relief obtained after extensive splanchnic-nerve section is outlined in another table in the original article.

Surgical therapy is apparently an effective method of checking the progress of hypertension.

The selection of patients with early hypertension and the use of improved technique seem to be two important factors in obtaining good results.

DAVID J. IMPASTATO, M.D.

MISCELLANEOUS

King, A. B., and Ford, F. R.: A Clinical and Anatomical Study of Neurological Conditions Resulting from Metastases in the Central Nervous System Due to Carcinoma of the Lung. *Bull. Johns Hopkins Hosp., Balt.*, 1942, 70: 124.

Pulmonary carcinoma, because of its great tendency to metastasize to the central nervous system, frequently produces bizarre and puzzling neurological symptoms. In an effort to study more closely the distribution of, and clinical signs produced by, metastatic pulmonary carcinoma, King and Ford reviewed 100 cases from the files of the Johns Hopkins and Baltimore City hospitals in which complete post-mortem examination of the nervous system had been made.

Metastatic deposits in the nervous system were found in 27 cases, a percentage compatible with that found by other authors. Ford and King ascribe the extraordinarily high incidence of cerebral metastases to the fact that malignant cells may be transported directly to the blood stream without passing through the capillary bed of the lungs.

In 20 of the 27 cases, multiple small metastases were scattered throughout the brain with no particular areas of predilection. The bones of the skull were involved in only 4 instances. Whenever the spinal cord was involved, only the meninges were affected; there were no metastases within the substance of the spinal cord.

An interesting observation was the presence of metastases in the adrenal glands in more than half of the cases. The authors believe these played a role in causing the weakness and cachexia so often noted clinically.

In 8 cases the neurological signs were consistent with a single lesion in the brain. Focal signs developed rapidly and were often preceded by convulsions. The presence of papilledema was noted twice but only late in the course of the disease.

In 6 cases there were signs of multiple cerebral lesions but in only 1 case was papilledema present.

There were 6 cases in which the outstanding clinical sign was stupor—focal signs were absent or negligible and in only 1 of the cases was papilledema present. In none of these instances was the proper diagnosis made as the pulmonary lesion was silent.

In 4 cases the spinal cord alone was involved and although 2 cases presented multiple foci at autopsy, the neurological picture in each case was that of a single lesion, the lower focus being masked by the higher one.

In but 1 case was there evidence of lesions in both the brain and spinal cord. In 4 cases cerebral metastases were found at autopsy, which had failed to produce neurological signs during life.

Since papilledema was present in but 5 of the 27 cases, the authors conclude that increased intracranial pressure is not a frequent finding in this condition, and that it occurs only late in the disease. Severe headache, however, was frequent. Mental disorders such as dullness, drowsiness, stupor, or delirium were noted in most of the cases.

Ventriculography was performed 7 times and in 2 instances no significant ventricular distortion was observed. The explanation may depend upon the smallness of the tumors or that the aggregate of many lesions may leave the ventricular system with nearly normal symmetry.

Roentgenograms of the skull and skeleton rarely reveal metastases in those patients with neurological signs, and, on the contrary, the bones may be riddled, and at autopsy the brain will not show involvement.

Since the lung tumor often may be silent when the neurological symptoms are well advanced, the authors emphasize that a careful roentgenographic study should be made of the chest whenever an intracranial or intraspinal neoplasm is suspected and in all cases of unexplained stupor.

LAURENCE M. WEINBERGER, M.D.

SURGERY OF THE THORAX

TRACHEA, LUNGS, AND PLEURA

Wright, G. W., and Woodruff, W.: Bronchospirography. Ventilation and Oxygen Absorption of Normal and Diseased Lungs During Nitrogen Respiration in the Opposite Lung. *J. Thoracic Surg.*, 1942, 11: 278.

This article deals principally with an attempt to determine the capacity of the contralateral lung to take up increased amounts of oxygen when oxygen absorption by the side to be collapsed is blocked by the respiration of pure nitrogen.

When one lung breathes room air and the other pure nitrogen, there is an increase in the amount of oxygen picked up by the side breathing room air, and in most instances there is also an increase in ventilation. The increase in ventilation exhibited by the lung breathing room air shows very little direct relation to the percentage of total oxygen consumption blocked by the nitrogen or to the degree of lowering of the arterial blood saturation. The authors believe this to be due to the natural variations in sensitivity of the nerve centers controlling ventilation and to the depressant action of narcotics upon these same centers.

They emphasize the fact that the mechanisms brought into play by their experiments are not identical with those which occur when one lung is collapsed by a surgical procedure. They have attempted to increase the amount of oxygen picked up by the lung opposite the one to be collapsed in an effort to detect some disability on its part to accomplish this task. Although diseased lungs appear to show less ability to increase their oxygen absorption than do normal ones, the difference is not as striking as had been expected. It is possible that a more clear-cut incapacity may be revealed by more extensively damaged lungs.

ANTHONY F. SAVA, M.D.

Chamberlain, J. M., and Gordon, J.: The Treatment of Endobronchial Tuberculosis. *J. Thoracic Surg.*, 1942, 11: 292.

The authors' report represents a study of 100 cases of endobronchial disease complicating pulmonary tuberculosis. The condition in these cases was of such severity that its presence was indisputable. Doubtful cases were excluded.

Endobronchial tuberculosis is a problem of mechanical obstruction in a patient with pulmonary tuberculosis, and obstructive emphysema, bronchiectasis, and atelectasis are therefore frequent complications of this disease. Since both acute and chronic endobronchial tuberculosis cause obstruction, it is fair to assume that the physiological morbidity from such obstruction is directly affected by the location of the involved bronchus, the degree of the stenosis, and the duration of the obstruction. When a prolonged, severe obstruction occurs in the stem of the bronchus, almost complete loss of respiratory function may be the result. Endobronchial tuberculosis tends to run a self-limited course and therefore the "healed" fibrostenotic end-stage is often seen in the presence of an uncontrolled parenchymal lesion, but a stenosis that is sufficient to embarrass the cleansing mechanism of the lung is consistently followed by irreversible complications, namely, emphysema, atelectasis, and bronchiectasis.

Of great importance is the early recognition of the disease, and a negative bronchoscopy in the presence of convincing evidence of endobronchial tuberculosis simply localizes the disease beyond the bronchoscopic field. When a severe, acute lesion is discovered in a major bronchus, the experienced bronchoscopist may predict with considerable accuracy the stenotic end-result, and therapy must be established with this end in view.

Reduction in the size of the pulmonary bed should be considered when the amount of obstruction or the amount of anticipated obstruction is determined. Collapse of the lung is desirable because the pulmonary lesion is more likely to heal and such a lung is less vulnerable to secondary suppuration. If the sputum remains positive in the presence of adequate collapse of the lung, bronchoscopic examination and local therapy may be indicated. External drainage of a pulmonary cavity is sometimes necessary. The Monaldi technique of drainage was resorted to when local therapy failed. In selected cases, lobectomy or pneumonectomy may be indicated. Finally, thoracoplasty done in small stages under local anesthesia is the most effective solution of this problem. It will control the pulmonary lesion, reduce the pulmonary bed to a minimum, and eliminate any pleural complications. Atelectasis should be prevented by frequent coughing, intratracheal catheter suction, or bronchoscopic aspiration when necessary. A vigilant nursing personnel is indispensable to a successful outcome.

ANTHONY F. SAVA, M.D.

Elwood, B. J., Potter, B. P., Sacco, A. G., and Pagliughi, J. J.: The Importance of Control of a Pulmonary Lesion When Tuberculous Tracheobronchitis Coexists. *Arch. Otolar.*, Chic., 1942, 35: 408.

The importance of tuberculous tracheobronchitis coexisting with pulmonary tuberculosis is being more frequently recognized through the use of endoscopic examination. Although much has been learned concerning its pathological and clinical characteristics there remains much controversy regarding the proper management of the pulmonary lesion in the presence of tracheobronchial involvement.

The authors report the results of 302 bronchoscopies in a series of 137 selected patients with pulmonary tuberculosis, 79 (58 per cent) of whom also

had a tracheobronchitis. With increased knowledge of the characteristics of this condition bronchoscopic confirmation of clinically suspected cases increased from 26 per cent in 1937 and 1938 to 69 per cent in 1940 and 1941. The chief symptoms suggestive of tracheobronchitis are wheezing, difficult expectoration, irritative spasmodic cough, paroxysmal dyspnea, and recurrent hemoptysis. The incidence of a tracheobronchitis was higher in the presence of noncavernous lesions, 55 in 85 as compared to 24 in 52 in the presence of demonstrable cavities. Usually the tracheobronchial involvement was found on the same side as the predominant pulmonary lesion. Of the 79 cases, only 7 presented a tuberculous lesion in the trachea alone, while both trachea and one or more bronchi were involved in 28 cases, and only bronchial lesions were found in the remainder (44 cases).

Therapeutic measures in patients having both pulmonary and tracheobronchial lesions entail the treatment of both lesions. When cavities are present some form of collapse therapy is indicated in addition to the basic treatment of the pulmonary tuberculosis. Local treatment of the tracheobronchial lesions consisted of chemical cauterization with silver nitrate solutions of from 5 to 25 per cent strength. Granulations and fibrous bands were carefully removed with biopsy forceps in addition to applying the cautery to improve the patency of the airway.

The authors believed that the treatment of the coexistent pulmonary lesion was as important or more important than the local treatment of the tracheobronchial lesion. Healing of the former lesion is apt to be followed or accompanied by healing of the latter. The contrary is apt to be the case when the pulmonary lesion cannot be controlled.

WILLIAM E. ADAMS, M.D.

Brea, M. M., Nino, F. L., and Taiana, J. A.: Hepatopulmonary Amebiasis (Amebiasis hépato pulmonar.) *Bol. y trab., Acad. argent. de cirug.*, 1941, 25: 1350.

The authors report hepatopulmonary amebiasis in a twenty-five-year-old man complaining of fever, malaise, hemoptysis, abundant expectoration, and diarrhea. There was a tenderness over the right lower chest and dullness in the same region on percussion. The abdominal muscles over the right upper quadrant were rigid; other important symptoms were tachycardia, urobilinuria, and chocolate-colored sputum. No parasites could be detected in the sputum or the feces. X-ray examinations revealed an elevation and deformity of the right dome of the diaphragm and an infiltration of the lower portion of the right lung, which formed a dense shadow with supernatant fluid and air.

An aspiration of the right lower lung disclosed the presence of dysenteric entameba. A transparietal injection of lipiodol demonstrated a communication between the liver and the pulmonary shadow. Evidently there was an adherence between the liver, diaphragm, and adjacent portions of the right lung.

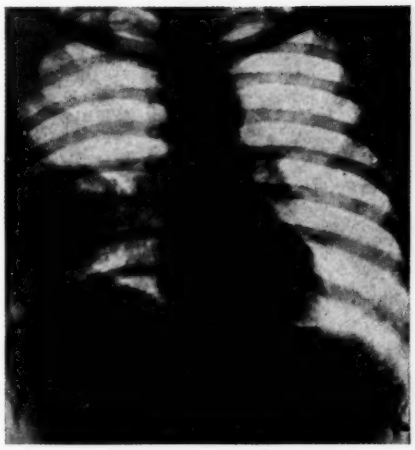

Fig. 1. Hepatopulmonary amebiasis. Deformity and elevation of the diaphragm. Cavity in right lung filled with fluid and air.

The patient made a prompt recovery after the use of emetine and yatren.

The authors state that in spite of an endemic of amebiasis in Argentine, its pulmonary location is rare, and a communication between a pulmonary abscess and the liver is very unusual. During the infiltrative or pneumonic period the symptoms of an amebic abscess are nonspecific, but in course of the following period of suppuration or liquefaction, bile may appear in the sputum if the communication with the liver is wide. A concurrent presence of blood is reponsible for the characteristic chocolate-like appearance of the sputum.

JOSEPH K. NARAT, M.D.

Cherry, H. H.: Prevention of Tissue Emphysema Following Closed Pneumonolysis. *J. Thorac. Surg.*, 1942, 11: 451.

A common although not serious complication of closed pneumonolysis is tissue emphysema. Because of the accumulation of large amounts of air in the fascial planes and subcutaneously distributed over a wide surface area from the head to the perineum and at times involving the extremities, it appears quite alarming, but is not dangerous since the air is eventually absorbed. The source of air is the pneumothorax produced and the air gains exit to the tissues through the trocar wounds. These wounds are commonly closed with interrupted sutures and a pressure bandage applied to prevent the escape of air. Welcher and Groves have devised a procedure for obtaining firm pressure on the parietal pleura, thus preventing the escape of air, but this necessitates the use of a third cannula.

The author describes and illustrates a method of applying two sutures for obtaining obliteration of the trochar tract throughout its course external to

the intercostal muscles, which has greatly decreased the production of tissue emphysema when combined with strapping of the chest. The two linen sutures are placed with a medium weight, full curved, cutting edged needle 2½ in. in length. They are so placed that their deep segments circle the wound at the desired level, and interlock so that when tension is applied the tract can be obliterated. Dental rolls are used for quilling, the skin margins being approximated with the sutures used for obliteration of the trochar pathway. The sutures are removed on the sixth day. WILLIAM E. ADAMS, M.D.

HEART AND PERICARDIUM

Thompson, S. A., and Raisbeck, M. J.: Cardiopericardiopexy. The Surgical Treatment of Coronary Arterial Disease by the Establishment of Adhesive Pericarditis. *Ann. Int. Med.*, 1942, 16: 495.

The rationale of surgery in the treatment of disease of the coronary arteries is to decrease the work of the heart or to increase the blood supply to the myocardium, and has to do with operative procedures upon the sympathetic nervous system, the thyroid gland, and upon the heart itself.

Grafting tissue onto the myocardium produces a collateral circulation in two ways: (1) by stimulating an increase in the size and function of the collateral channels already present in the heart (intracardiac); and (2) by the formation of new channels from the grafted tissue to the myocardium (extracardiac). The tissue used as grafts are muscle, omentum, lung, and pericardium.

The ability of the pericardium to serve as the source of a collateral circulation has been known for some time; and as a result of animal experimentation, it was definitely recommended for such use in 1932 by Hudson, Moritz, and Wearn. The blood supply of the pericardium comes from aortic branches, from the internal mammary artery, the esophageal, the phrenic, the bronchial, the mediastinal, and the coronary arteries themselves.

The experimental evidence supporting this procedure is reviewed by the authors. Sterile talc powder (hydrous magnesium silicate) is introduced into the pericardial sac, which produces a foreign-body reaction characterized by fibrinous pericarditis, with little or no fluid formation. This technique does not produce a constrictive pericarditis. As early as eighteen hours after the introduction of the powder, the pericardium becomes adherent to the epicardium at the site of insertion. After one week, the two surfaces are firmly adherent, and in four weeks the pericardium and epicardium are fused as one layer of tissue. The presence of blood vessels from the pericardium to the epicardium was demonstrated at subsequent operations when the separation of these two tissues produced bleeding. Microscopic sections of injected specimens showed blood vessels going from one tissue to the other (Fig. 1). Following the introduction of the talc there occurs an inflammatory reaction involving the pleura, pericardium, epicardium, and adjacent myocardium. The reaction persists for two or three weeks, then subsides. Because of the inefficient lymphatic supply of the pericardium and the large size of the powder particles, little if any of the powder is removed from the pericardial sac. Augmentation of the coronary circulation by adhesive pericarditis may occur in any or all of three ways: (1) by the formation of new channels between the main coronaries, (2) by dilatation and proliferation of already existing intercoronary channels, or (3) by the formation of new extracardiac channels from the grafted pericardium.

The operation can be done in about twenty minutes. The procedure is as follows: an incision about 3 in. long is made over the left fifth costal cartilage, the median end of the incision being at the costosternal junction. The incision is carried down to the costal cartilage. The perichondrium is incised and stripped from the cartilage anteriorly and posteriorly, and about 1½ in. of the cartilage is removed. The posterior perichondrium is incised for 1½ in., which exposes the anterior mediastinum. Care is taken not to injure the internal mammary artery which is now exposed. This artery and vein are now retracted medially. This approach is over the so-called free space and the pleura does not usually appear in the field. However, if it is present, it is gently retracted laterally, which exposes the pericardium. The pericardium is picked up by hemostats and a 1 in. incision is made through an avascular area. A small rubber suction tube is inserted into the pericardial sac and any fluid present is removed. Five cubic centimeters of a 2 per cent solution of novocaine are then dropped onto the epicardium to prevent fibrillation. This is allowed to remain in the pericardial sac for four or five minutes and is then removed by suction. The heart is now palpated with one finger inserted into the pericardial sac. Any infarcts or scars are noted, as well as the presence or absence of adhesions of the pericardium to the epicardium. Approximately 2 drams of sterile, dry talc powder are now spread over the anterior surface and the inferior and left borders of the heart. The powder may be applied by a spatula or by an atomizer. The pericardial incision is now incompletely closed with No. 0 plain gut. The posterior perichondrium is closed with fine catgut. The muscles of the chest wall, severed in the approach, are now approximated and the skin is closed. No drain is inserted.

The medical problems arising in the treatment of these cases include the following: (1) the establishment of criteria for the selection of patients, (2) preoperative study and preparation, (3) postoperative management, and (4) a careful evaluation of the results.

SELECTION OF CASES

The authors selected patients for this treatment with the following factors in mind:

1. A definite and clearly defined anginal syndrome, pain of characteristic nature and distribution, and particularly with a definite relationship to effort.

2. Objective evidence of coronary and myocardial disease in the form of positive physical, electrocardiographic, and roentgenological findings.

3. The absence of improvement after fairly prolonged medical treatment and an extreme degree of disability, corresponding at least to Class III of the Heart Association Classification.

4. A previous coronary occlusion was not considered a contraindication. However, sufficient time must have elapsed to permit healing of the infarct.

5. Basal pulmonary edema, hepatomegaly, and peripheral edema are contraindications to operation. Operation was performed in 2 cases of congestive heart failure, following a preliminary period of treatment consisting of rest, digitalization, and diuretic measures, and was well tolerated by the patients.

PREOPERATIVE STUDY

Routine workup consisted of detailed history, and a complete physical examination, followed by an electrocardiogram which included at least two chest leads (CR-2 and CR-4), a 2 meter chest plate with fluoroscopy, and the determination of circulation time, venous pressure, and in some cases the anoxemia test (R. L. Levy *et al*, 1938), to bring out latent disease of the coronary vessels not apparent in the routine electrocardiograms. Venous-pressure determinations were made for comparison with postoperative readings to determine whether any obstruction to the return flow to the heart by reason of pericardial bands or adhesions had occurred. The venous pressure after operation has, in general, remained normal or somewhat lower than the preoperative, without any abnormal rise in any of the patients reported upon, after a three-year follow-up.

Preoperative medication varied according to the individual indications. Digitalis was used when necessary. Quinidine sulfate was used routinely (0.20 gm., or 3 gr.) at intervals of four hours for several doses immediately preceding operation, the last dose timed to be given within two hours of operation. This was done to decrease the danger of the development of ectopic rhythms during operation. Preoperative sedation consisted of the administration of morphine (gr. 1/6 to 1/4) and atropine (gr. 1/100), the atropine being repeated immediately after operation.

The anesthetics used have been cyclopropane and oxygen, with concentrations of 25 per cent cyclopropane and 75 per cent oxygen. If there were any signs of ectopic beats during operation, an extra dose of atropine (gr. 1/100) was given at once.

POSTOPERATIVE COURSE

There is a febrile reaction, with a fever of 103°F. by the second or third postoperative day, which subsides gradually in from ten to fourteen days. In 1 case the temperature rose to 104°F. and fell to normal only after three weeks. Pericardial friction rubs have been audible fairly promptly, and can be heard over the entire precordium by the third day. Within from twenty-four to thirty-six hours after operation, signs of consolidation of the left lower lobe appear. Rales are rare but the breath sounds are bronchial in character, audible chiefly in the left axilla and below the angle of the left scapula. There is no cough or expectoration, and the patient does not appear to be as sick as his chart would suggest. The physical signs clear up in a week usually.

Fig. 1. Photomicrograph (high power) of a section of a dog's heart following cardiopericardiopexy and ligation of a main coronary artery. The dog was sacrificed and the heart injected with India ink.

The arrows at A point to the line of cardiopericardial adhesions. M, myocardium; P, pericardium. Notice the large vessel filled with ink, crossing directly between the pericardium and myocardium

Postoperative medication consists of oxygen, given as a routine during the first two days by double nasal catheter. Moderate doses of morphine have sufficed to control pain and cough during the first two or three days. It was not found necessary to continue the quinidine after operation. Sulfathiazole has been used, in moderate doses, during the first three to five days, until it was believed that the regression of the physical signs and the control of the temperature were satisfactory. Some distress in moving the left arm or shoulder is due to the attachment of the pectoral muscles in the neighborhood of the operative wound; this clears up in a few weeks.

EVALUATION OF RESULTS

The series, of which the case histories are reported in detail at the end of the paper, consisted of 13 patients, most of whom were cardiac derelicts with

poor prognoses. Four died, 1 within a few hours after operation, 2 on the second postoperative day, and the last three weeks after surgery was tried. All of the 9 remaining patients secured some relief, which was striking in several cases and permitted a return to normal exercise. The authors first case now dates back over three years and the improvement is marked (estimated by the patient as 75 per cent), and in their second case, dating back nearly two and a half years, the patient shows marked improvement and has a normal exercise tolerance.

EUGENE J. AUDI, M.D.

ESOPHAGUS AND MEDIASTINUM

Fuhrman, M., Dragutsky, D., Rook, G., and Grossman, L.: Congenital Atresia of the Esophagus. *Radiology*, 1942, 38: 326.

Congenital atresia of the esophagus is comparatively rare. It may occur in a variety of forms, the commonest being the one in which the upper segment terminates blindly and the lower communicates with the trachea or with the bronchi near the level of bifurcation of the trachea. Two cases of this type observed by the authors are reported in detail.

Constant drooling, the reappearance of frothy mucus in the mouth and pharynx following frequent pharyngeal aspiration, repeated regurgitation after feeding, followed by coughing, cyanosis, and dyspnea are sufficiently characteristic of the condition for a presumptive diagnosis. Although successful surgical interventions for it have not yet been reported it is believed that such results can be anticipated if the lesion is recognized early. The use of liquid contrast media for visualization of the esophagus and possible harmful sequelae are discussed. A new, simple, harmless procedure—aeroesophagography—is proposed, whereby the upper esophageal segment may be demonstrated by the injection of air through a soft rubber catheter introduced into the esophagus.

A. HARTUNG, M.D.

Elkeles, A.: A Case of the Plummer-Vinson Syndrome with Roentgenologically Demonstrable Peptic Ulcer of the Esophagus. *Brit. J. Radiol.*, 1942, 15: 122.

The Plummer-Vinson syndrome is characterized by dysphagia associated with hypochromic microcytic anemia. Although the condition was originally thought to be purely functional, subsequent studies revealed that atrophic changes in the mouth, glossitis, and a postcricoid web could be recognized in connection with it, and achlorhydria was often present. The postcricoid web has been demonstrated by roentgen examinations.

The author cites a case in detail to illustrate that the organic changes in the syndrome are not necessarily confined to the mouth and upper part of the esophagus. In this case a peptic ulcer was diagnosed near the cardiac end of the esophagus with roentgen findings of niche and spasm. Treatment with large doses of anahemin and campolon daily, combined with iron and ammonium citrate, led to rapid improvement. This would tend to confirm the theory advanced by some authors, that iron deficiency is an essential factor in the development of the syndrome.

A. HARTUNG, M.D.

Smith, A. B., and Bowser, J. F.: Spontaneous Pneumomediastinum with Reports of 2 Cases in Infants. *Radiology*, 1942, 38: 314.

The literature relating to mediastinal emphysema is briefly reviewed including experimental studies and case reports. The normal anatomy of the mediastinum is presented and the pathological changes associated with mediastinal and interstitial emphysema are described. The numerous mechanisms of its production are mentioned and its effects are ascribed to increased mediastinal pressure, the outstanding result of which is a mechanical interference with the circulation due to compression of the large veins entering both sides of the heart.

The seriousness of this condition depends upon the amount of air that enters the mediastinum and the pressure that is built up in it. Precordial pain, persistent dyspnea, and signs of increasing circulatory embarrassment should suggest the possibility of this condition in the absence of evidence of other lesions which may produce these symptoms. A distinctive sign of it is a peculiar crunching, crackling, bubbling sound heard over the heart with each contraction, due to compression of the air-filled mediastinal tissues lying between the heart and the anterior chest wall. The diagnosis is assured by the appearance of air in the subcutaneous tissues of the neck. Roentgenography of the chest, especially in the lateral projection, is diagnostic. Treatment should be directed toward controlling the source of air and giving an outlet to the air already accumulated.

Two cases observed by the authors in infants are cited in detail and illustrated by roentgenograms.

A. HARTUNG, M.D.

MISCELLANEOUS

Miller, I.: Vital-Capacity Studies in the Aged. *J. Lab. & Clin. Med.*, 1942, 27: 737.

Vital capacity as a measure of respiratory efficiency has been used since 1846. Standards of measurement have been set up, based on various factors, i.e., height, weight, surface area, occupation, and other factors. The author gives a review of the literature, cites several references, and uses these factors in determining the normal vital capacity for different classes of individuals. A number of reports were in agreement that the vital capacity decreased after fifty or sixty years of age. The amount of diminution varied. Loomis reported about 32 per cent between the ages of sixty and eighty years; Meyers, 44 to 53 per cent; Levy, a decrease of from 2,980 cc. at sixty to sixty-five years to 2,350 cc. at the ages of eighty-six to ninety-four in men, and from 1,985 cc. at sixty-five years to 1,460 cc. at eighty-six to ninety-two years in women.

The author's own study was based on the results in 744 men, forty years of age and over, the tests being made during the afternoon. A thirty-minute rest period preceded the test. The weight and sitting height were determined for correlation with the vital capacity. The results were as follows: a decrease was shown in the average vital capacity of from 3,150 cc. at forty to forty-four years to 2,400 cc. at ninety to ninety-four years. The decrease in percentage was from 79 to 62. The average vital capacity in the aged was thought to be due to several factors, viz., less elasticity of the lung, fixation of the thoracic cage, and diminution of the muscular power for producing the respiratory effort.

Pathological processes involving the lungs, such as tuberculosis, silicosis, emphysema, and bronchiectasis, were found to cause a diminution in vital capacity of various degrees (40 to 55 per cent) below the normal for their age groups. Compensated cardiovascular disease (102 cases) appeared to produce little or no change in the vital capacity. Vital capacity determinations were significant only when properly interpreted. Pulmonary pathology may exist in the presence of a normal vital capacity. A vital capacity below 90 per cent of normal, if found on repeated tests, is usually important. Excessive exercise will produce dyspnea. If the vital capacity is reduced to from 40 to 70 per cent of normal, only light work can be done, and if it is shown to be below 40 per cent the patients are usually dyspneic without effort

WILLIAM E. ADAMS, M.D.

Kerley, P.: Wounds of the Diaphragm. *Brit. J. Radiol.*, 1942, 15: 97.

Wounds of the diaphragm are often unsuspected or overlooked. A case of this kind, in which the roentgen findings were correlated with the operative, is reported in detail.

A study of this case leads the author to believe that the immediate diagnosis can be made by careful roentgen examination. He bases this opinion on the following findings:

1. Invisibility of the injured dome. This is probably caused by eccentric contraction on either side of the tear. The presence of a blood clot may also play a part in concealing the dome.
2. Intermittent twitching visible on the screen.
3. The presence of a pneumoperitoneum if the entrance wound is thoracic. On the other hand, if the entrance wound is abdominal and a viscus has been penetrated, there will be a pneumothorax.
4. An extensive wound of the lung with hemorrhagic atelectasis and little blood in the pleural cavity. As these patients are usually most comfortable in the semirecumbent position, much of the blood will find its way into the abdominal cavity. This also accounts for the absence of a fluid level.

A. HARTUNG. M.D.

SURGERY OF THE ABDOMEN

ABDOMINAL WALL AND PERITONEUM

Rees, C. E.: Femoral Hernia. A Modified Position for Its Repair. *California & West. Med.*, 1942, 56: 134.

Rees calls attention to the fact that the femoral vein may be injured during the repair of femoral hernia. The vein lies lateral to the canal and ring, sometimes under the sac. The direction of the vein in this region is downward and 15 degrees inward (medial). Its presence narrows the operative field, and because of its proximity to the operating position a large space is often left under the inguinal ligament through which a femoral hernia may recur.

The direction of the vein can be changed from 15 degrees inward, to 35 degrees or more outward, by abduction of the hip, which is obtained by allowing the flexed knee to hang over the side of the operating table. Further displacement of the vein can be obtained by flexion and external rotation of the hip, but this position tenses the structures of the ring and of the canal. Either position displaces the vein laterally at the ring, and thus clears the surgical field sufficiently to permit not only safer, but also more lateral, placing of the sutures. A more complete closure of the ring is obtained. Simple abduction is the position of choice.

After the sac has been ligated and the sutures have been placed with the hip in abduction, the leg should be brought back on the table parallel with the other leg so that the vein may be under observation during the tying of the sutures. J. M. MORA, M.D.

Tanner, N. C.: A "Slide" Operation for Inguinal and Femoral Hernia. *Brit. J. Surg.*, 1942, 29: 285.

Inasmuch as the rate of recurrence of direct hernias repaired by standard procedures averages from 20 to 25 per cent or more, no completely satisfactory operation has been found for strengthening a weakened inguinal or crural canal. Ogilvie and others have pointed out that suturing of the conjoined tendon to Poupart's ligament (inguinal ligament) has one principal defect. In approximating these structures "the muscle is pulled far out of line of its fibers and of its action and the sutures are tied under tension." In some instances the fibers of the internal oblique muscle are absent or atrophied. Straining will tend to separate the two structures, which will leave defects at the site of the stitch holes, or perhaps complete separation may occur. Even should the sutures remain as placed, the distortion of the muscle fibers may result in their improper function with subsequent atrophy. The turning-over of a winged flap of the rectus sheath leaves a wide weak area lateral to the rectus. Bloodgood's transposition of the rectus sheath and muscle distorts the anatomy so that the rectus muscle must later atrophy. Thinning of the external oblique aponeurosis often precludes the advisability of performing a Wyllys-Andrews procedure. Complete transposition of the cord superficial to the external oblique aponeurosis takes no account of the sphincteric mechanism of the inguinal canal and leaves a direct route for recurrence.

Fascial sutures have not given entirely satisfactory results. These sutures may be absorbed, and the risk of infection is considerably greater. Also a certain number of patients develop pain in the wound at the donor site of the fascia.

The operation to be described can be applied to the largest direct inguinal hernia as well as to recurrent and strangulated hernias. Its advantages are listed as follows:

1. No foreign material is used in the repair except a moderate number of silk sutures.

2. By displacement of the insertion of the lower fibers of the internal oblique muscle these fibers approach and lie parallel to Poupart's ligament, so that when lightly sutured to it they neither atrophy nor tear away.

3. The new posterior wall of the inguinal canal retains its full and undisturbed blood supply.

4. The neighboring structures are not appreciably weakened.

5. There is minimal anatomical interference and so the operation is rapid and safe.

The skin incision may be in the usual oblique direction or placed slightly more transversely. The approach to the inguinal canal and spermatic cord is performed in the usual manner. If only an indirect sac is found this is treated in the usual manner with ligation at the internal abdominal ring, which is in turn narrowed as indicated. Any defect in the transversalis fascia is then repaired by suturing it to Poupart's ligament and the canal is repaired anatomically.

If the hernia is of the wide-necked direct variety the slide operation is performed as follows:

By blunt and sharp dissection, the aponeurosis of the external oblique muscle is separated from the underlying fibers of the internal oblique muscle. This dissection is continued medially with separation of the aponeurosis of the external oblique muscle from that of the internal oblique over the rectus muscle for a distance equal to the junction of the medial, third, and lateral two-thirds of the muscle. A vertical curved incision is then made in the fused aponeurosis of the internal oblique and transversus muscles, commencing at or just below the level of the pubic crest and continuing as far medially as the dissection will allow. This incision is carried upward for a distance of one hand's breadth with a lateral curve at the upper extremity and should end about 2 cm. from the lateral border of the muscle. The sliding of the lateral part of the fused aponeurosis made by this incision may be impeded by attachments to the pyramidalis muscle. These can be readily

freed by dissection. The lateral margin of the sliding flap is then sutured to the shelving margin of Poupart's ligament with interrupted silk sutures. The location and type of incision allows this to be accomplished without exertion of tension on the suture line. The authors claim that this also does not involve pulling of the muscle fibers out of their original alignment, and does not split or distort the muscle. In those cases with a thinned and stretched transversalis fascia the suture may be taken so as to include first the margin of the sliding fascia, the transversalis fascia, and then Poupart's ligament, and thus avoid the placing of two rows of sutures in Poupart's ligament. The lateral margin of the incision which has now resulted in a gaping aperture is now sutured to the pyramidalis and rectus muscles with a continuous silk suture. This is to prevent an overslide of these muscles. The external oblique muscle is now closed with a continuous catgut suture which restores the normal covering of the inguinal canal.

The operation is modified to adapt itself to femoral hernias. The femoral hernia is approached through the inguinal canal and the transversalis fascia is then incised over the crural canal. After reduction of the sac and its excision the sliding flap is prepared as for the direct inguinal hernia. However, in suture of the lateral margin of the sliding portion of fascia, the sutures are placed first through the sliding fascia, then the transversalis fascia, and finally into the ligament of Ashley Cooper. The suturing of the remainder of the sliding flap is continued laterally so as to attach it to Poupart's ligament. The repair of the lateral margin of the incision in the fused aponeurosis of the internal oblique and transversus muscles is performed as in the direct-hernia procedure.

The contraindications for this procedure are listed as follows:

1. Hernias in which a posterior repair is unnecessary.
2. Hernias containing infected or gangrenous bowel.
3. Hernias with evidence of previous damage to the rectus abdominis.

Age and poor health are not contraindications.

The author reports using this procedure on 116 hernias. ALFRED B. LONGACRE, M.D.

GASTROINTESTINAL TRACT

Palmer, W. L.: Peptic Ulcer and Gastric Secretion. *Arch. Surg.*, 1942, 44: 452.

The role of the digestive action of gastric juice in the problem of peptic ulcer has long been recognized by clinicians. The purpose of the present article is to discuss the present status of the subject and the therapeutic implications. From a practical point of view, erosion and truly acute ulcer are of little importance for they heal rapidly and produce few or no symptoms. The subacute and chronic lesions are the ulcers to be primarily considered.

Peptic ulcer occurs in persons with a low secretory rate as well as in those with a high secretory rate. Chronic ulcer does not occur, however, in patients with complete and persistent achlorhydria. Clinicians have long been aware of the fact that the excessive continued night secretion constitutes one of the greatest difficulties in ulcer therapy. There is abundant evidence that, as a rule, the gastric secretion secreted per hour and per twenty-four hours in patients with peptic ulcer exceeds in amount that found in normal persons.

The ulcer lesion begins in the mucosa, increases in size and in depth by invasion, and is definitely a penetrative process. Mann and others have shown conclusively that the experimental ulcers are identical in pathological appearance and behavior with peptic ulcer in the human being. The presence of acid gastric juice is essential for the production of such lesions. It appears to be the one indispensable factor. Pepsin also greatly facilitates the process, but it alone will not produce ulcer. The chief protection against the acid attack on the cells of the mucosa seems to be provided by the mucus with which they are covered. Factors such as thrombosis, embolism, and infection are not essential factors in ulcer pathogenesis.

It appears that peptic ulcer results from a failure of the cells of the mucosa and of the wall of the stomach and intestine to withstand the digestive action of acid gastric juice. The cause of this failure is not clear. At all events, the acid attack exceeds the capacity of the protective mechanism.

The pain resultant from ulcer is due to the direct irritation of the nerve endings by the acid solution of the stomach.

All ulcers heal, at least the majority, in spite of the presence of acid gastric juice. This is shown by the spontaneous remissions so characteristic of the disease and by the healed lesions encountered in routine autopsy work. Daily clinical experience supports the theory that healing is more rapid and more certain when the lesion is protected from the acid gastric juice. There is a great deal of direct and indirect evidence that the problem of ulcer therapy would be solved if there were available a safe and suitable method of producing complete and permanent achlorhydria. There is none short of total gastrectomy.

The most effective means of promoting healing is to prevent the ulcer from coming in contact with acid gastric juice. The chief difficulty with the various surgical methods of treatment, including subtotal gastrectomy, is not that they fail to lead to the healing of the primary ulcer but rather that new ulcers tend to form at the new stomas.

Medical methods of treatment are less certain and less spectacular. The oldest therapy consisted of rest and a milk diet. Milk is one of the best neutralizers of acid gastric juice: 10 cc. of milk will neutralize 11 cc. of 0.3 per cent of hydrochloric acid. All protein foods have definite neutralizing values. Active medical treatment is indicated in all cases of

active peptic ulcer. The indications for operation arise from the complications of the ulcer. Perforation, massive hemorrhage, and pyloric stenosis are surgical conditions which often complicate the original ulcer. Gastric ulcer should be removed surgically if there is any question of its malignant nature. It should be recognized that no medical or surgical procedure with the exception of total gastrectomy will regularly result in complete achlorhydria. JOHN W. NUZUM, M.D.

Partipilo, A. V., and Wiltrakis, G. A.: Duodenal Obstruction. *Surgery*, 1942, 11: 557.

In its broadest sense, duodenal obstruction may be defined as an impediment or hindrance to the forward passage of duodenal contents caused by acquired or congenital conditions. The obstruction may be acute or chronic, complete or incomplete, the characteristic feature being a dilated duodenum. As a clinical entity, the condition is neither well understood nor generally appreciated. The terminology used to describe the various types of duodenal obstruction is in a chaotic state. The writers suggest that the term "duodenal obstruction" be applied universally regardless of the etiological factor.

The diagnosis of duodenal obstruction may be arrived at readily in some cases, while in others it is not so obvious. No single symptom or combination of symptoms or physical findings is pathognomonic. A thorough knowledge and familiarity with the subject and the utilization of this knowledge in the differential diagnosis of all obscure upper abdominal diseases are essential to a correct diagnosis. Careful roentgen studies will confirm the diagnosis in many cases.

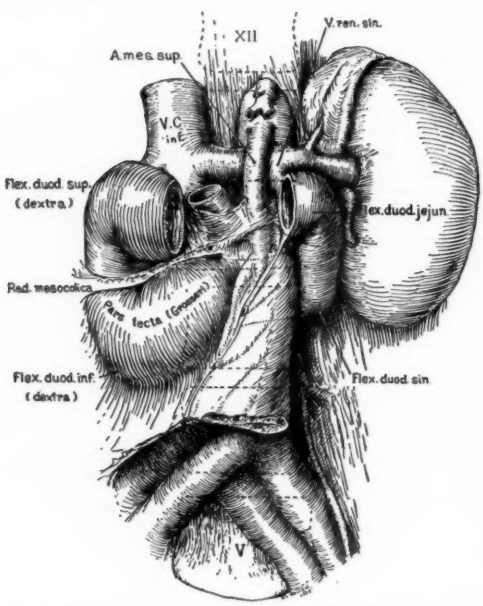

Fig. 1. Drawing showing the topographical relationship of the duodenum, the left renal vein, and the superior mesenteric artery. (Courtesy of Dr. Bila Halpert.)

Both medical and surgical treatments were considered in detail. Medical treatment for the visceroptotic type was discussed in detail. Six cases were reported by the writers: (1) typical arteriomesenteric obstruction; (2) megaduodenum due to adherent transverse colon into the pelvis; (3) embryonal band attaching about 3 in. of the jejunum to the transverse mesocolon, associated with perforation and bleeding ulcers; (4) carcinoma of the terminal duodenum; (5) duodenal obstruction by extension of glands, the result of Hodgkin's disease; and (6) duodenal compression due to pressure from an aneurysm of the abdominal aorta.

JOHN W. NUZUM, M.D.

Itoiz, O. A., and Otero, E. R.: Congenital Microcolon (Microcolon congenito). *Arch. Soc. argent. de anat. normal y patol.*, 1941, 3: 79.

A girl baby was born June 6, 1939, of a normal mother who had two healthy children. The labor was normal and the child apparently so but after two hours she vomited meconium. The vomiting was repeated during the day. An enema was not retained. Roentgen examination showed the colon to be very small throughout its length. The barium passed through the ileocecal valve into the small intestine, which was greatly dilated.

The abdomen was opened and the last loop of dilated intestine opened through the abdominal wall at a point that was thought to be near the cecum. The child died of malnutrition on June 29.

Post-mortem examination showed the artificial anus at a distance of 27 cm. from the ileocecal valve. The cecum was identified by the small appendix. The terminal part of the small intestine between the cecum and the artificial anus was very much contracted, as was the colon. The stomach was normal. There were no microscopic lesions in the intestine except at the beginning of the constricted part of the small intestine where there was an intense fibrosis of the muscle layer and deposits of calcium.

Apparently this was a case of congenital microcolon brought about by some unknown disease of the terminal part of the ileum which had prevented accumulation of meconium in the large intestine, and resulted in its contraction from lack of functional stimulus.

The authors believe that in such cases the establishment of an artificial anus is not indicated if the stricture originates in the small intestine. If the obstruction is not absolute he believes that a high jejunostomy or continuous aspiration with an intestinal sound would give better chances of survival and perhaps ultimate cure.

In the discussion Brachetto-Brian said that he believed the name congenital microcolon is incorrect, as the origin of the lesion lies in the small intestine.

He thinks that interruption or atresia of the small intestine would be the correct name.

AUDREY G. MORGAN M.D.

Bower, J. O., Terzian, L. A., Burns, J. C., Trachtenberg, H. B., and Pearce, A. E.: Appendical Peritonitis. *J. Am. M. Ass.*, 1942, 118: 1284.

The most effective means of reducing the high mortality of appendical peritonitis is the prevention of perforation of the acutely inflamed appendix by teaching the public the dangers of taking laxatives and delaying hospitalization in the presence of abdominal pain. These investigations have already been reported under the prophylactic aspect of the Philadelphia plan.

The scientific aspect presented here includes experimental and clinical research to develop an improved management of patients suffering with spreading peritonitis and to provide continuous research toward further improvement.

The dog has proved to be well adapted for experimental investigations because:

1. Peritonitis similar to that observed complicating acute appendicitis in man can be induced in the dog by ligating the mesentery and the base of the appendix and administering castor oil immediately after operation.

2. Gross tissue reactions in the dog following the induction of gangrene of the appendix are similar to those observed in gangrenous appendicitis in man.

3. Changes in the cellular content and chemical composition of the blood and peritoneal exudate preceding rupture and development of the localizing or spreading process are similar in man and dog.

4. Symptoms and signs accompanying microorganismal invasion of the peritoneal cavity are likewise similar in the two species.

5. Recovery from spreading peritonitis in man is preceded or accompanied by the development of an abscess. The dog that recovers from induced spreading peritonitis also develops an abscess which is absorbed.

6. Death occurs in both man and dog because the reactive capacity of their tissues to the microorganismal invasion is inadequate.

As these similarities were recognized, the practicability of using the reactions in the dog to measure the value of different methods of management of appendical peritonitis in man became evident. Variables are few. The incidence and mortality of peritonitis in dogs could be varied by withholding or changing the time of administration of the amount of laxatives following ligation of the appendix: without administration of a laxative, 50 per cent of the dogs recovered after an appendical abscess had developed; when 30 cc. of castor oil was given twenty-four hours after operation 68 per cent died; when 60 cc. of castor oil was given immediately after operation 91 per cent died.

Of the patients admitted to hospitals in Pennsylvania with a diagnosis of acute appendicitis or appendical peritonitis, 3,427 had not received laxatives and only 1 in 62 had died; 5,868 had taken one laxative and 1 in 19 died; 921 had taken more than one and 1 in 9 died.

Both man and dogs react similarly to surgical procedures instituted in the presence of localizing or spreading peritonitis. Dogs invariably die soon after operations performed during the active stages of an induced peritonitis, and death occurs earlier and more frequently in man when removal or attempted removal of the appendix is instituted before the peritoneal infection becomes localized. Likewise, the investigation of agents for combating the toxemia of spreading peritonitis showed that those which produced the lowest mortality in dogs reduced the mortality in man in the same degree when the method of administration and dosage were the same.

The intravenous administration of lyophylized convalescent peritonitis plasma is advised in the treatment of patients suffering from appendical peritonitis. The optimum management of such patients can be carried out only with the aid of a competent clinical biochemist, on whose determinations the institution of therapy in great part depends.

Blood transfusions, in the opinion of the authors, should be replaced by infusion of human plasma in the early stages of peritonitis. The convalescent stage of peritonitis is accompanied by hypoproteinemia and anemia. Lyophilized convalescent-peritonitis pooled plasma makes immediate administration possible and diminishes the likelihood of reactions. The lyophilization does not affect the specific antibody content of plasma. JOHN W. NUZUM, M.D.

Harken, D. E.: Congenital Malformations of the Rectum and Anus. *Surgery*, 1942, 11: 422.

Harken considers the volume of isolated case reports on congenital malformations of the rectum and anus as tremendous. There are, however, few reports presenting any considerable number of cases. He therefore submits a series of 25 personal cases extending over a period of years, sufficient for the ascertainment of certain facts related to therapy and prognosis.

First, these congenital malformations of the anus and rectum represent arrests and perversions in the embryological development, and may be classified into four types:

1. Incomplete rupture of the anal membrane, or stenosis from 1 to 4 cm. above the anus.
2. Imperforate anus; patency interrupted by an anal membrane only.
3. Imperforate anus, also an incomplete rectum, the large intestine ending blindly as a pouch, within or above the pelvis.
4. Apparently normal anus and lower rectal pouch, but not communicating with the blind overlying rectal pouch.

The two blind pouches may be separated by a thin membrane, or considerable tissue may intervene. Any of these types may occur in males or females, and in either sex the incidence of fistulas is considerable. The most common type of anomaly in either

sex is Type 3. The most common types of fistulas in the two sexes are the rectourethral in the male, and the rectovaginal in the female.

The surgical treatment of these anomalies is discussed cursorily. The most satisfactory therapeutic results may be expected in those patients having only a thin obstructing diaphragm, and in the females with large rectovaginal fistulas that allow postponement of the operation until the patient is from one to three years old. Patients with these anorectal anomalies suffer a high, nonsurgical mortality, partially due to the high incidence of associated congenital abnormalities, and the physiological and psychological factors justify heroic measures to establish the normal anatomical relationships. The clinical impression that most, if not all, of these patients have normal anal sphincters would seem to be supported by embryological and histological evidence.

Of the series of patients reported, 10 are still living; 7 regarded as having clinical cures and good rectal control. Seven had associated rectourethral fistulas, while 3 had associated rectovaginal fistulas.

STEPHEN A. ZIEMAN, M.D.

Laufman, H., and Diamond, M.: The Treatment of Anorectal Infections with Suppositories Containing Sulfanilamide and Local Anesthetic; Preliminary Report. *Am. J. Digest. Dis.*, 1942, 1: 144.

Since sulfanilamide is known to have an inhibitory effect on the growth of bacteria commonly found in human feces it was thought that sulfanilamide in suppository form might be of some value in the local treatment of low-grade anorectal infections. The authors used suppositories containing sulfanilamide plus an anesthetic agent, gamma—(2 methylpiperidino) propyl benzoate hydrochloride, so-called metycaine, in a water-soluble base. As a control, two other types of suppositories were used. The first type contained no medicaments, but consisted of the water-soluble base alone. The second type contained only sulfanilamide in the water-soluble base. The placebo suppository served to show the value of lubrication alone in the treatment of painful conditions of the anorectum.

It was found that the suppositories containing sulfanilamide plus metycaine not only gave rapid subjective relief but gave the best end-results.

Thirty-one unselected cases of various types of nonsuppurative anorectal inflammations were treated with these suppositories. Suppository therapy was used in conjunction with other general and local measures such as mineral oil by mouth, increased fluid intake, and low residue diet in those patients whose symptoms indicated the need for this regime.

The most striking observation in this series was the rapid subsidence of local inflammatory signs. In past experience it had been noted that despite the symptomatic relief afforded by suppositories or other measures, the local signs of mucosal and submucosal inflammation, as observed proctoscopically, usually cleared up very slowly or not at all. When suppositories containing sulfanilamide plus metycaine were used as a supplement to the necessary local procedures, cures were obtained in a higher proportion of cases and within a shorter period of time than had been noted by previous experience with other measures.

This is a preliminary report. Further investigation is continuing with suppositories containing 5 per cent sulfathiozole and metycaine.

HAROLD LAUFMAN, M.D.

David, V. C., and Gilchrist, R. K.: Extension of the Border Line of Operability in Cancer of the Rectum. *Ann. Surg.*, 1942, 115: 566.

The authors discuss a group of patients with cancer of the rectum having one or more factors which increase the hazards of operation and which in some instances decrease the chances of long-term survival. It is the belief of the authors that the indications for operation should be broadened as long as the mortality rate can be kept within reasonable bounds and the long-term survival rate reasonably high.

During the last ten years, many patients with cancer of the rectum who formerly were considered inoperable have had radical resections with results satisfactory enough to warrant extension of the border line of operability. Conditions which formerly were considered to render such patients inoperable were age, adiposity, attachment of the tumor to surrounding parts, and metastasis to the liver. During the period from 1930 to 1941, 277 patients were admitted to the hospital for operation for cancer of the rectum. Of these, 5 were deemed inoperable because of local fixation or involvement of unremovable tissue. There was an operability rate of 65.8 per cent and a hospital mortality rate of 7.2 per cent. Among the 179 patients operated upon, there were 129 one-stage abdominoperineal resections with a 10 per cent mortality, 28 two-stage Mummery operations, 16 obstruction resections at the rectosigmoid, 5 local removals of small tumors, and 1 resection at the peritoneal reflection, with no deaths. Of the 93 inoperable patients, 84 were given a colostomy, with 2 deaths.

The choice of operation in patients over sixty-five years of age was somewhat different than in patients under sixty-five. In the latter group a one-stage abdominoperineal operation was almost invariably done. In the former group 22 patients had a one-stage abdominoperineal resection with a mortality of 18.2 per cent. Seven patients had a two-stage Mummery operation, 3 an obstruction resection, and 3 a local removal of the tumor, the latter groups with no mortality.

Even though the operative risk in this group of patients had been high, the authors feel sure that they have given years of life expectancy to a considerable number.

There was a relatively larger number of patients in which the tumor was adherent to structures outside of the bowel. In the past five years an attempt

has been made to be more radical in resecting such tumors. A large part of the prostate gland was resected with the tumor in 5 patients, the rectovaginal septum in 6, the uterus and adnexa in 4, the ureter in 2, the dome and posterior half of the bladder in 1, and another loop of bowel in 1. There were only 2 postoperative deaths in this group, 1 from pneumonia and 1 from sepsis.

The presence of one or more small nodules in the liver did not prevent the authors from undertaking radical resection because the differential diagnosis between early carcinoma of the liver and an adenoma or angioma is very difficult to make by touch. Of 15 patients in this group, 4 have had recurrence in the liver and have died on the average of ten months postoperatively. Four of these patients are alive from three to five years postoperatively, which would seem to justify giving patients with questionable lesions in the liver a operative chance of cure.

Among the 10 very obese patients in this series there was 1 postoperative death from embolism and 1 evisceration which was repaired and from which the patient recovered. In 4 patients having a perforation of the tumor, the soft-part inflammatory mass was removed with the tumor. One of these patients died of postoperative peritonitis while the other 3 are alive from three to five years after operation.

Among the miscellaneous factors making operability somewhat doubtful were peritoneal plaques over the tumor (5 patients), diabetes (5 patients), pregnancy (2 patients), removal of local recurrences (3 patients), coronary disease (2 patients), fixation of the tumor to the abdominal wall (2 patients), ulcerative colitis (1 patient), asthma and bronchiectasis (1 patient), involvement of inguinal nodes (2 patients), double carcinoma of the rectum (1 patient), and involvement of an extensive rectal fistula with transplanted cancer from an adenocarcinoma of the ampulla (1 patient).

Of the 105 patients classed as being doubtfully operable there were 18 having more than one factor influencing that decision. In that group there were only 2 hospital deaths. HAROLD LAUFMAN, M.D.

LIVER, GALL BLADDER, PANCREAS, AND SPLEEN

Cutler, E. C.: The Care of Patients with Biliary Disease. *Canadian M. Ass. J.*, 1942, 46: 218.

Gall stones are a relatively frequent natural phenomenon, and their incidence increases with longevity. Women are affected three times as often as men. The finding of stones without symptoms is no reason for surgery.

Two-thirds of the patients with chronic cholecystitis give a history of right upper quadrant pain, referred to the back; while not more than one-third complain of epigastric distress, in contrast to patients with acute cholecystitis or common-duct stone, whose epigastric pain is possibly due to pancreatic involvement. About 10 per cent have left upper quadrant or left infrascapular pain, and often have been diagnosed as having angina pectoris. Vomiting is not a prominent symptom unless the calculus is located within one of the major hepatic ducts.

Patients with chronic cholecystitis and stone typically give a history of chronic indigestion unrelated to their dietary regimen or physical activity. Typical attacks of colic in the right upper quadrant and jaundice obviate the necessity for the Graham-Cole test. Physical examination is often inconclusive between attacks, except for the probable evidence of adiposity. The serum diastase and icteric index may be elevated.

One of the most serious and frequent mistakes the surgeon makes in the treatment of chronic cholecystitis and cholelithiasis is his failure to search for and remove calculi lodged in the extrahepatic bile ducts. The incidence of choledochostomy in patients with cholelithiasis should be somewhere between 40 and 50 per cent of all operations for stone, and adds little to the risk.

A dilated common duct or a palpable stone within it indicates that the duct should be opened, but many a common duct, long involved with inflammation, may remain small though seriously obstructed by stone.

The diagnosis of stone in the common duct is made in the presence of colic, vomiting, chills and fever, jaundice, and a past history consistent with the diagnosis of cholelithiasis. It occurs nine times in women to once in men. In the presence of jaundice, Courvoisier's law should be invoked.

If the blood diastase is elevated, surgery should be delayed until the level falls to normal, which it usually does in three or four days. When the prothrombin time is extended, Vitamin K should be given until a normal level is found, as well as during the first week of convalescence. A high intake of carbohydrate must be ensured, as well as of protein (which can be given intravenously as plasma or serum).

Acute cholecystitis is manifested by pain beneath the right costal margin or epigastrium, which is constant and steady in nature. Tenderness and spasm are usually present, but a palpable mass can be felt in only one-third of the cases. Fever and leucocytosis are present. In the treatment of these patients, immediate hospitalization is advised. About half will respond to conservative measures, consisting of the administration of fluids intravenously, sedatives, and heat to the abdomen. Frequent evaluation of signs, symptoms, and laboratory data must be made, and the optimum time for operation, early or delayed, should be determined by the patient's response, each case being an individual surgical problem. Cholecystostomy is the operation of choice in the fulminating cases, and this group should have subsequent cholecystectomy.

The chief technical consideration is adequate illumination of the operative field. The direction of the incision does not help in reducing postoperative pulmonary complications. Visualization of the common duct before applying clamps to the cystic duct is a vital safeguard. Any gall bladder which impairs

vision should be emptied with a trocar. Blind clamping above the cystic duct is dangerous as many anomalies of the cystic artery are to be found. The defect in the liver bed should be closed, and a rubber-covered drain inserted.

If choledochostomy is to be performed, the common duct is opened between silk sutures, then probed, scooped, and irrigated with saline solution. The smallest possible catheter is sutured pointing upward into the common duct, and is pulled out of the wound in five or six days. Drainage of the biliary tract is merely a safety valve, and not more than 300 cubic centimeters of bile should be collected in any given day.

Each case should be followed up for years in order to make a fair appraisal of the benefits of the surgical procedure. S. LLOYD TEITELMAN, M.D.

Berman, C.: The Etiology of Primary Carcinoma, with Special Reference to the Bantu Races of South Africa. *South African J. M. Sc.*, 1941, 6: 145.

Primary carcinoma of the liver is a disease in which racial factors appear to play a prominent part. It is very rare among all white-skinned races, irrespective of geographical distribution, but it is common among most pigmented races, particularly the Bantu, the Javanese, and the Japanese. In the Bantu it is pre-eminently an affection of the young adult males. In 82.6 per cent of all cases the patients were forty years of age or under, the highest figure (44.4 per cent) being recorded in the decennium from twenty-one to thirty years. The pigmented races appear to vary in susceptibility among themselves. The highest incidence was registered in the Bantu, the Javanese, and the Japanese. These were followed by the Chinese, the Philippine Islanders, and the British Indians. Moreover, the statistics for the Bantu have indicated that there is an extraordinary difference in incidence even among different tribes of the same race. The East Coast Bantu appears to be six times more susceptible to primary liver cancer than the South African Bantu.

Certain questions remain to be answered. Is it merely a problem of heredity, or are there some unknown extrinsic carcinogenic factors—specific for the liver—common to most pigmented races but absent in Europeans; or is it a combination of heredity and toxic activity? Why does it affect males predominantly and why the extraordinarily early age? Is the cancer initiated by chemical agents similar to o-aminoazotoluene and "butter-yellow"? It appears that cirrhosis of the liver is an intermediate state in the evolution of cancer of the liver. Multilobular cirrhosis was an accompaniment in every Bantu case studied, and in 73 per cent of the cases recorded in the literature. The chief toxic agents apparently concerned in the production of cirrhosis are helminthiasis, malaria, schistosomiasis, hemochromatosis, and alcohol. Among other races, additional factors considered are infestation with taenia echinococcus, opisthorchis felineus, and clonorchis sinensis.

A "keloid" diathesis may have a special bearing on the etiology of primary carcinoma of the liver in the Bantu, for these people exhibit pronounced connective-tissue hyperplasia even after seemingly unimportant superficial wounds. It is possible that minor injuries sustained in the Bantu liver, which are normally followed by negligible fibrotic reactions in white-skinned races, may conceivably assume enormous proportions. This intense fibrous-tissue hyperplasia may initiate those changes which ultimately lead to liver cancer. The exact mode of neoplastic transformation is unknown. Some pathologists assume that adenomatous tissue arises as the result of attempts at compensation for destroyed liver parenchyma; at a later stage, this in turn is said to suffer cancerous transformation.

No precise details can be offered regarding the length of time required by the carcinogenic irritants to initiate tumor growth. Primary carcinoma of the liver is remarkable in that the disease may remain unnoticed for months, or possibly even years. Subjective symptoms often appear only when the tumor has attained enormous dimensions, eroded a large blood vessel, or even after metastases have already disseminated to distant organs.

The salient features which emerge from a consideration of the etiological factors are that irritation is apparently responsible for the production of precancerous or even cancerous states of the liver, and that the irritants must act on a favorably prepared soil. The nature of the soil which facilitates the action of hepatic irritants in the genesis of primary liver cancer is possibly determined on a racial basis.

MANUEL E. LICHTENSTEIN, M.D.

Glenn, F., and Moore, S. W.: Gangrene and Perforation of the Wall of the Gall Bladder; a Sequela of Acute Cholecystitis. *Arch. Surg.*, 1942, 44: 677.

Gangrene of a portion of the entire wall of the gall bladder is a sequela of acute cholecystitis and frequently leads to perforation. A single area of gangrene of the gall-bladder wall may result in perforation. Gangrene of the wall of the gall bladder is often the result of changes that take place in the organ during an attack of acute cholecystitis. Findings frequently encountered are a stone impacted in the ampulla of the gall bladder, edema of the gall-bladder wall, blockage of the lymphatics, obstruction of the venous return, and arterial occlusion.

Glenn and Moore believe that another mechanism which may lead to perforation is a process similar to the formation of diverticula. Sinuses are frequently present in the walls of infected gall bladders. It is believed that these sinuses are enlarged by forceful contractions of the organ and that in one or more sinuses the mucosal layer is forced through the supporting structure of the wall of the gall bladder to become branched with a small neck communicating with the inner aspect of the organ. Changes within the wall of the gall bladder may result in occlusion of this outlet with the formation of a potential abscess. As the abscess increases in size it extends in

the line of least resistance, which is usually toward the periphery. If the periphery is covered with peritoneum, rupture may be prevented, but if there is no peritoneum, as in the hepatic portion of the gall bladder, perforation may occur rapidly. Perforation may occur through the peritoneal surface of the gall bladder and if it is not protected by adherent viscera, rupture occurs into the peritoneal cavity. Such a mechanism could account for multiple perforations.

Gangrene of the gall bladder occurs more frequently than is generally assumed. In a period of eight years, Glenn and Moore have observed 84 patients in whom gangrene of the gall-bladder wall occurred. In 59 of these, there was no evidence of perforation, but in the majority of the patients the omentum and adjacent viscera had become adherent to the gall bladder. In 22 patients there was perforation and localized peritonitis, or localized abscess. There were 3 patients with perforation into the free peritoneal cavity; of these, 2 died.

Differential diagnosis of acute conditions commonly found in the upper right quadrant of the abdomen taxes the diagnostic acumen of the most experienced abdominal surgeon. A differential diagnosis appears less important than an attitude which leads to surgical treatment. The purpose of reporting this series of patients with gangrene of the wall of the gall bladder is to emphasize the advisability of surgical treatment of the patient with acute cholecystitis. EARL GARSIDE, M.D.

Everett, C., and Macumber, H. E.: Anomalous Distribution of the Extrahepatic Biliary Ducts. *Ann. Surg.*, 1942, 115: 472.

The authors present a case report of an unusual anomaly of the extrahepatic biliary tract.

The patient was a white woman of 71 years, who gave a history of severe epigastric and right upper quadrant pain, nausea and vomiting, jaundice for two weeks, and a weight loss of 65 lb. in the last two years.

The skin and sclerae were icteric, and there was tenderness and the sensation of a mass in the right upper quadrant. The blood showed a moderate leucocytosis, the urine showed traces of bile, and the stools were all dark brown or green.

Roentgenograms showed several small shadows in the region of the duodenal cap, apparently due to barium in the biliary passages, but the gall bladder did not visualize. The stomach and duodenum appeared normal.

At operation the gall bladder could not be found. The common duct was dilated but no stones were palpated; the duct was not opened, and the abdomen was closed without further procedure. The course was complicated by evisceration on the fifth postoperative day, and death occurred on the fourteenth postoperative day.

At autopsy the liver was found to be normal, and no evidence of a gall bladder was found. The main hepatic duct was greatly dilated and divided into two branches; one emptied into the second portion of the duodenum at the ampulla of Vater; the other emptied into the lesser curvature of the stomach just proximal to the pyloric ring (Fig. 1).

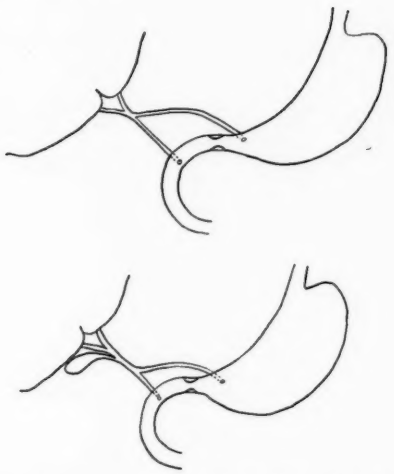

Fig. 1. top, Congenital aplasia of gall bladder and high bifurcation of the common duct; one branch emptying into the second part of the duodenum, the other branch emptying into the stomach near the pylorus.

Fig. 2. Vesale's case; similar to the authors' except for presence of the gall bladder. (Courtesy of J. B. Lippincott Co.)

A study of the literature revealed that cases in which the common duct emptied into the stomach totalled only 4, and that aplasia of the gall bladder is also a rare anomaly. S. LLOYD TEITELMAN, M.D.

Clute, H. M.: Bile-Duct Reconstruction with Vitallium Tubes. *New England J. Med.*, 1942, 226: 484.

Following Pearse's idea of using a vitallium tube to replace or reconstruct an injured common bile duct, the author used this method in a very difficult common-duct stricture.

A thirty-eight-year-old woman who had had a cholecystectomy performed for gallstones somewhere else 16 months previously was admitted to the hospital. At the time of the first operation hemorrhage had occurred from the cystic artery, and a clamp had been hurriedly applied and left in place for twenty-four hours. It apparently included the cystic artery and the uppermost portion of the common hepatic duct in its grasp. The common duct was explored four months later, because of attacks of pain, fever, chills, and jaundice. No stones were found. A stricture was discovered but was considered inoperable.

At operation on July 27, 1939, the author found a stricture, almost complete, very high in the common hepatic duct. The stricture was incised longitudinally, and a rubber T-tube placed in it. The patient was well for five months with the tube in place. It

Fig. 1. The vitallium tube has been inserted into the stump of the common hepatic duct, being held in place with silk sutures. The distal portion of the common duct has been freed.

was then accidentally pulled out. Soon after that, attacks of pain, chills, fever, and jaundice recurred.

At operation April 14, 1940, the author exposed the strictured common duct with great difficulty. About 0.3 cm. of the common hepatic duct was present. The duodenum was freed, and a hepaticoduodenostomy was performed. A ring of fibrous tissue about the opening of the common hepatic duct made him fear that the new opening might contract

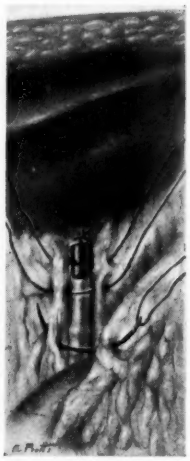

Fig. 2. The vitallium tube has been placed in the common duct. It should be noted that a portion of the duct is completely lacking. Convenient fat tabs and omentum were used to cover the exposed tube.

Fig. 3. This x-ray film, taken some months postoperatively, shows the vitallium tube in the common bile duct and its relation to the barium-filled stomach.

and obstruct. After six or seven months this occurred, and the attacks of pain, chills, fever, and jaundice returned.

On November 29 the author again exposed the common-duct area, cutting the duodenum free from its anastomosis to the common hepatic duct. The anastomosis had diminished to pin-point size. By means of an opening in the duodenum, a probe was inserted through the ampulla of Vater, and the distal portion of the common duct was demonstrated. The duodenum was closed and the common hepatic duct was dissected free as it lay in liver tissue. Its opening was a ring of firm, fibrous scar tissue. In the hepatic duct was much detritus, as well as many tiny black gall stones. The opening of this duct was enlarged so that the trumpet-shaped end of a vitallium tube could be inserted and held securely with silk sutures (Fig. 1). The distal end of the tube was placed in the distal portion of the common bile duct, about 2 cm. of which were absent. Omentum was brought in to surround the tube (Fig. 2). A jejunostomy was made for feeding. A drain was placed in the region of the anastomosis, but not close to it.

Recovery was entirely uneventful. The patient was entirely well for six months and then had one attack of pain and transient jaundice. X-ray examination at this time showed no evident change in the position of the tube (Fig. 3). No further attacks have occurred and the patient was very well when last seen (March, 1942). CHARLES BARON, M.D.

GYNECOLOGY

ADNEXAL AND PERIUTERINE CONDITIONS

Stohr, G.: Granulosa-Cell Tumor of the Ovary and Coincident Carcinoma of the Uterus. *Am. J. Obst. & Gynec.*, 1942, 43: 586.

Three cases of granulosa-cell tumor of the ovary are described in which the glandular hyperplasia of the endometrium attained the character of neoplastic growth that is productive of a variety of malignant features.

Granulosa-cell tumors are not differentiated only by their morphological criteria but manifest themselves also by their specific biological function, which is focused in the elaboration of estrogenic hormone, and subsequently by their growth-promoting effect upon those organs which physiologically are subjected to estrogenic stimulation. Predominant among them is the uterus, which responds by muscular hypertrophy and by proliferation of the mucosa, as observed in the many instances of recorded granulosa-cell tumors.

In the cases described unusual responsiveness of the endometrial tissue was apparent by the excess growth and by development in a malignant form conditioned by the prolonged hormone elaboration of the tumor cells. Therefore, these cases may be accepted as spontaneous biological experiments in the human being in analogy with those growth processes experimentally induced in organs of the reproductive tract of animals, particularly in those of tumor-susceptible strains.

As observed in the study of large series of granulosa-cell tumors the responsiveness of the endometrium to the granulosa-cell tumor varies considerbly in the different cases. It may be assumed that in certain individuals, like tumor susceptibility in certain animals of the same species, a specific readiness exists in the tissue cells (endometrium) to multiply in excess and in unlimited fashion, when stimulated by estrogenic substances.

Other factors, too, may be involved which, at present, can only be conjectured. These are possibly individual variations of the tumor bearer in regard to the metabolism of the sex sterols or quantitative variations of the hormone-genetic potency of the elements of the granulosa-cell tumor. Here it is of importance to note that in all 3 cases described the cells of the tumors were of mature character, reaching in the last case the highest degree of differentiation expressed by the faculty to form folliclelike structures; whereas in tumors with markedly undifferentiated cell types, as in the cases of frank granulosa-cell carcinoma, atrophy of the endometrium is generally observed. Hence, it may be inferred that the closer the approach to the mature form of the granulosa cell of the graafian follicle, the more extensive the production of the hormone and the greater the growth-inducive stimulus.

In 1 case the return of regular menstrual cycles after removal of the tumor indicated restored gonadial function, as substantiated by the second curettage which yielded a normal secretory mucosa, and by the further clinical course.

EDWARD L. CORNELL, M.D.

MISCELLANEOUS

Sturgis, S. H.: The Use of Stilbestrol in the Relief of Essential Dysmenorrhea. *New England J. Med.*, 1942, 226: 371.

In a previous article, this author pointed out that women with "essential dysmenorrhea" obtained complete relief from cramps when treated with estradiol benzoate. However, this satisfactory response occurred only when the course of treatment was started early in the menstrual cycle, i.e., at least twenty-one days before the expected onset of menses. The painless bleeding which followed was considered a result of estrin withdrawal. The absence of secretory response in the endometrial biopsies from treated patients was considered evidence that ovulation had been suppressed. The maturation of graafian follicles was prevented when follicle stimulation by the pituitary gland was blocked at least seven days before ovulation should occur. When estrin treatment was started too late, the follicles matured, the patient developed secretory endometrium, and the menstrual period was accompanied by cramps.

The present article is an analysis of the results obtained from the oral administration of stilbestrol in the same group of patients that had previously responded to the subcutaneous administration of estradiol. The dramatic relief from cramps during the first flow after cessation of a course of estradiol was used as the criterion to evaluate the effectiveness of other types of therapy. This series included 19 women who complained of disabling cramps every month, but who showed no organic pelvic disease. They had been under observation at the Massachusetts General Hospital, in Boston, for at least four years.

These women received 79 courses of stilbestrol orally, and cramps were satisfactorily eliminated 59 times—an efficiency of 74 per cent. The daily dose of 1 or 2 mgm. of stilbestrol was continued for from ten to twenty-four days. It had been found that 6 injections of 1.66 mgm. of estradiol benzoate were necessary to cause withdrawal bleeding, and the same effect in this same group of women was obtained consistently with approximately 20 mgm. of stilbestrol given orally. The 20 failures occurred in 11 different patients; 17 failures because the treatment was started too late in the cycle to prevent ovulation. It is impossible to establish an arbitrary day in the cycle when treatment should be started.

Every patient exhibits some variation in the length of her cycles. This variation usually occurs in the phase of follicle ripening, whereas the luteal phase of approximately two weeks appears to be relatively constant. To obtain consistent suppression of ovulation with estrin, one should have access to a careful record of at least 8 consecutive menstrual cycles. Treatment must be started early enough, and continued long enough, to care for the longest and the shortest cycles that the patient has manifested in the previous eight months. Estrin must be started early enough to prevent ovulation; it must be continued long enough to cause endometrial proliferation, after which there will be withdrawal bleeding when the medication is stopped. Withdrawal bleeding after estradiol has been given usually starts in from four to ten days after the last injection. After stilbestrol, this bleeding occurs in from four to nine days.

Estrin therapy offers nothing as a permanent cure; it only gives temporary relief. All patients complained of the same disabling cramps when estrin was not given. These patients have been followed for only four years, but there is no evidence that the repeated induction of anovulatory bleeding causes permanent damage either to the pituitary gland or the ovaries. One of the most striking features of this study was the invariable recurrence of characteristic dysmenorrhea when no treatment was given.

The author concludes that stilbestrol is equally as effective as estradiol benzoate in relieving essential dysmenorrhea. He believes that estrin therapy primarily inhibits the follicle-stimulating hormone fraction of the pituitary gland, and as a result suppresses the growth of ovarian follicles. Twenty per cent of the patients could not continue with stilbestrol because of gastro-intestinal symptoms.

GEORGE H. GARDNER, M.D.

Bennett, H. G., Jr., and Te Linde, R. W.: The Menopausal Syndrome. *J. Am. M. Ass.*, 1942, 118: 1341.

The present study is concerned with the treatment of 45 patients with menopausal symptoms, in whom theelin was implanted. It is believed that the pellet implantation of crystalline estrone is the most effective method yet devised of combating the menopausal syndrome, and this treatment was found to be satisfactory in 93.4 per cent of the cases.

Implantations are made through a 12 gage hollow needle which is fitted with a stilet. The pellets are loaded into the pointed end of the needle with a small forceps and the needle is passed through the skin over the gluteal region, following procaine infiltration. Pressure on the stilet as the needle is withdrawn deposits the pellets in the subcutaneous tissues.

The average number of implantations was 1½. The average number of pellets per implantation has been 8; the average total weight was 40 mgm. During the past year a standard dose of 50 mgm. has been used almost routinely.

Patients were relieved for an average period of sixteen and two-tenths weeks. None of those who had been previously treated with estrogens administered by hypodermic injections showed less improvement from pellets, and in most cases the degree of relief was definitely greater with pellet implantation. The hormone is effective over a longer period of time when administered by implantation than when administered by any other method.

Implanted crystalline estrone pellets produced no untoward side effects in contrast to pellets of diethylstilbestrol.

The treatment was more completely effective in cases in which the symptoms had been present for less than a year, which suggests the value of early treatment before the neurasthenic tendencies of the patient are developed. There is, of course, the possibility that the symptoms will persist for more than a year only in the more severe cases, and the condition is therefore more refractory to treatment.

The authors do not believe that the vaginal smear is an altogether dependable indicator of the necessity of estrogen treatment in the menopause, nor is it of any great clinical value as an indicator of the effectiveness of the treatment of the symptoms. Although they believe that laboratory determinations of urinary estrogenic levels and gonadotropic hormone levels are valuable in evaluating a new therapeutic method, such determinations are not necessary in order to carry out satisfactory therapy in the individual patient.

CHARLES BARON, M.D.

OBSTETRICS

PREGNANCY AND ITS COMPLICATIONS

Anderson, G. W., and Musselman, L.: The Treatment of Tetany in Pregnancy. *Am. J. Obst. & Gynec.*, 1942, 43: 547.

A review of 240 cases of tetany in pregnancy, reported in the previous literature, has been presented. Classification of the cases into four types was attempted. Twenty-six cases were of the postoperative hypoparathyroid type of tetany with pregnancy; 145 were of the idiopathic or spontaneous type, including those cases which occurred during the pregnancy, during delivery, or in the post-partum period. The third type consisted of a dietary type, due to low calcium intakes and Vitamin D deficiencies, of which 9 cases were reviewed. The last type included 60 cases of tetany associated with thyroid deficiency disease.

During the past decade evidence has been accumulating which offers a much better prognosis for both the pregnant mother and her baby. A combination of oral and intravenous administration of calcium preparations, parathormone, and dihydrotachysterol (A. T. 10) carefully regulated by the patient and her physician yielded successful results in 12 of 13 cases in the literature (including 3 cases of postoperative type presented by the authors). Pre-eclamptic toxemia was present in the 1 unsuccessful case and premature induction of labor was necessary. In the authors' cases pre-eclampsia occurred twice. Therefore, concurrent toxemias must be watched for in cases of tetany in pregnancy. No abnormal alterations of the labors or of delivery were observed. Careful observations of mothers and babies revealed no unusual abnormalities. Therapeutic abortion is rarely indicated in the light of present-day therapy advocated for cases of tetany in pregnancy.

EDWARD L. CORNELL, M.D.

Plass, E. D.: Syphilis in Obstetrics. *Am. J. Obst. & Gynec.*, 1942, 43: 484.

Syphilis is an obstetrical problem of considerable significance among patients in the lower economic groups, even in a predominantly rural state, such as Iowa, where most of the people are native-born whites.

The fate of the offspring of syphilitic women appears to depend less upon the duration of the infection at the time of conception and previous antisyphilitic therapy than upon the character and extent of treatment during pregnancy.

None of the diagnostic measures available makes possible the determination of the syphilitic status of the child of a syphilitic woman during the neonatal period. Standard serological tests are practically pathognomonic at the age of two or three months and are alone to be depended upon as a means of diagnosis.

The syphilitic pregnant woman appears especially likely to develop treatment reactions to the arsenical antisyphilitic drugs, which should, therefore, be used with caution.

EDWARD L. CORNELL, M.D.

Domínguez Sisco, R., and Mendoza, E. S.: Incidence of Prenatal Syphilis Based on 400 Cases in the Municipal Maternity Hospital, "Concepcion Palacios" (Indice de sifilis prenatal sobre 400 observaciones practicadas en la Maternidad Municipal "Concepcion Palacios"). *Rev. de obst. y ginec.*, 1941, 1: 183.

The authors state that there is a high percentage of syphilitic pregnancies in Caracas (almost as high as in Paris), and the number of syphilitic newborn is proportionately high. They believe that the solution to the venereal problem is to educate the people. The treatment which offers the best results during pregnancy is the administration of arsenic bismuth.

The authors analyzed a series of 400 pregnant women, 65 per cent of whom were not married. Of the 400, 61 (16 per cent) were syphilitic, 300 (75 per cent) were healthy, and 39 (9 per cent) were doubtful. The stillbirth and abortion rate in the syphilitic group was 63 per cent as compared to 21 per cent in the control group. There were 48 per cent of the syphilitic group who bore weak or premature babies and 25 per cent in the control group.

The 63 per cent of cases clinically positive in the syphilitic group appears low but this can be explained by the fact that syphilis is a disease which can be easily disguised. The 5 per cent positive serology in the control group was explained by the fact that some of the patients had tuberculosis, small tumors, and other diseases capable of giving a positive reaction. The low per cent of splenomegaly in the experimental group (62 per cent) can be explained by the fact that the spleen is palpable in children who are not syphilitic. The presence of adenopathy in the newborn is of significance in the diagnosis of syphilis. The results of this study emphasize the importance of treating syphilitic pregnant women.

MICHAEL DEBAKEY, M.D.

Wilson, C. L., and Hesseltine, H. C.: The Effect of Lymphogranuloma Venereum on Pregnancy, Labor, and the Fetus. *Am. J. Obst. & Gynec.*, 1942, 43: 459.

Within the past four and one-half years, 17 patients with lymphogranuloma venereum have been observed at the Provident Hospital, Chicago; while within the past ten years only 1 such diagnosis has been made at the Chicago Lying-in Hospital.

These 18 mothers (17 colored and 1 white) received obstetrical care in 21 gestations during this study. Two therapeutic and 1 unintentional abortion account for the 3 losses of fetal life. Two mothers each had repeat pregnancies going to term unevent-

fully under these observations, while 1 had twins. These same 18 mothers had 58 pregnancies in all, 21 of which came under this study directly.

The gestations under study were carried to or near term and culminated in 19 living births (no stillbirths or neonatal deaths). All 19 babies were tested intradermally with at least one or more known dependable antigens from human sources. Twelve newborn infants were tested with mouse brain antigen and mouse brain control as well as with human test materials. These tests were made within the first ten days of life on 13 babies born from 10 mothers (2 repeat pregnancies and 1 twin pregnancy). Only 1 baby of 13 gave a positive test. These readings were made on the third and tenth days. Even this infant had a negative test within three months, and it has since remained negative. All babies were completely or partially breast fed by their mothers. It is pointed out that all of the mothers were apparently in the latent stage of the disease, and therefore probably noninfectious. All pregnancies continued without special therapy for the venereal disease.

Colostomy may offer technical difficulty either in a possible obstruction or by contamination at delivery, particularly if cesarean section is done. Pregnancy *per se* did not alter, apparently, the course of the disease. There is the possible hazard of mismanaged labor if the pelvis is obstructed.

EDWARD L. CORNELL, M.D.

Stansfield, F. R.: Vaginal Calculus. *J. Obst. & Gynaec. Brit. Emp.*, 1942, 49: 82.

Vaginal calculi are rare enough to make the author's case only the fifteenth reported in the literature. Two conditions are necessary for their formation: a congenital or acquired vaginal stricture, and urinary leakage into the vagina through a fistula or as the result of urinary incontinence. Before the childbearing age, the responsible factors appear to be congenital stricture of the vagina and urinary incontinence, while in adult life the etiological conditions are urinary fistulas and post-traumatic strictures of the vagina.

Calculi have been found of from millet-seed dimensions to solitary stones 4 in. in diameter. Foreign bodies have formed the nucleus of the stones, but the bulk of the latter are composed of urinary salts. Treatment is obviously removal, and occasionally fragmentation of the stone is necessary.

This case report concerns a primigravida at term. During labor a midwife examined her, discovered a hard mass measuring 1½ by ¾ by ¾ in. "on the cervix," scraped it off, and called the author in consultation. He found this calculus had occupied the left portion of a septate vagina; he divided the septum and later delivered the fetus. After delivery urinary incontinence through a tiny anterior vesicovaginal fistula was noted, and an indwelling catheter employed. Three months later the patient was contacted and asked to come back for operation, but she wrote that she was having no trouble.

Laboratory examination showed the stone to be composed of a central nucleus of blood pigments surrounded by a gray cortex of phosphates and carbonates.

E. S. BURGE, M.D.

LABOR AND ITS COMPLICATIONS

Bickers, W.: The Effect of Progesterone on Uterine Contractions. *Am. J. Obst. & Gynec.*, 1942, 43: 663.

Uterine contractions before and after the administration of synthetic progesterone subcutaneously have been studied by means of an intrauterine balloon connected to a mechanical ink recorder which recorded the contractions of the uterus on a kymograph.

Synthetic progesterone has no effect upon uterine contractions in the normal ovulatory cycle during either the follicular or the corpus-luteum phase. It also has no effect upon the high amplitude, hypertonic contractions of primary dysmenorrhea, the uterine contractions in threatened abortion, or the uterine contractions in the puerperium.

EDWARD L. CORNELL, M.D.

NEWBORN

Lund, C. J.: The Relation of Inhalation Analgesia and Anesthesia to Asphyxia Neonatorum. *Am. J. Obst. & Gynec.*, 1942, 43: 365.

The author reviewed 1,982 consecutive deliveries from the aspect of asphyxia neonatorum in relation to inhalation analgesic and anesthetic agents. Nitrous oxide, ethylene, and cyclopropane, when used as analgesic agents, did not materially influence the incidence of asphyxia neonatorum. Nitrous oxide, properly administered, was given for long periods of time without significant effects on fetal asphyxia. Cyclopropane and other agents when used in concentrations sufficient for anesthesia in operative delivery were accompanied by an increase in the incidence of fetal asphyxia.

The incidence of asphyxia neonatorum varied directly as the duration of the administration of cyclopropane anesthesia. There seemed to be no relationship between asphyxia neonatorum and the type of anesthetic technique. Prematurity, complications of pregnancy and labor, the method of delivery, and the misuse of analgesic agents were apparently of greater significance in asphyxia neonatorum than the various inhalation agents when properly administered. EDWARD L. CORNELL, M.D.

Sanford, H. N., Shmigelsky, I., and Chapin, J. M.: Is the Administration of Vitamin K to the Newborn of Clinical Value? *J. Am. M. Ass.*, 1942, 118: 697.

Sanford *et al.* of Chicago report a study of 1,693 newborn infants during the first ten days of life. To 711 of these babies Vitamin K was administered in an attempt to evaluate its worth relative to the prevention of hemorrhagic manifestations. It was observed that Vitamin K administered by mouth

to the infant (1 mgm., usual dose) increased the value of the plasma prothrombin over the cord plasma prothrombin. When Vitamin K was given to the mother (2 mgm. dose) prior to the birth of the infant, it was found that the plasma prothrombin of the mother and the cord plasma prothrombin of her infant were both increased above normal values.

The authors believe that to be effective the Vitamin K should be given at least five hours prior to delivery. Throughout the newborn period the plasma-prothrombin values of infants given Vitamin K, or of infants whose mothers had received it before delivery, remained well above that of normal infants.

The authors observed, however, that "the administration of Vitamin K did not affect the frequency of hemorrhagic manifestations." The percentage of mortality was the same for the treated as for the control group. Considerable discussion is given to the definition and interpretation of hemorrhagic disease of the newborn. It is recommended that infants suspected of cerebral hemorrhage be given Vitamin C. The authors have found that the Vitamin C in the blood is consistently low in newborn infants with cerebral hemorrhage.

WILLARD G. FRENCH, M.D

Sorsby, A., Hoffa, E. L., and Smellie, E. W.: Sulfapyridine in Ophthalmia Neonatorum. *Brit. M. J.*, 1942, 1: 323.

The authors treated 273 cases of ophthalmia neonatorum with sulfapyridine by mouth. Of these, 89 (27.3 per cent) were positive for the gonococcus and 233 were negative. Sulfapyridine was used irrespective of the organism, and clinically there appeared to be no obvious selective action on gonococci.

The method of treatment was as follows:

The initial dose was 0.25 gm., followed by 0.125 gm. every four hours, both day and night, so that the total twenty-four-hour dose was 0.875 gm. on the first day and 0.75 gm. on subsequent days.

Within a period of eight days, 61.9 per cent of the patients were cured clinically, as against 15.2 per cent by local methods. There were many rapid recoveries following the administration of sulfapyridine. One hundred and twenty-six of 200 recoveries were in patients who were negative for the gonococcus, as against 43 of 73 in patients with gonococcal infection. This is considered noteworthy since sulfapyridine is regarded as a specific against the gonococcus and is expected to react feebly against the staphylococcus and against any other organism commonly seen in nongonococcal ophthalmia neonatorum.

No complications of any kind were observed in the present series of cases. Tolerance was apparently good. This was apparent by the regular gain in weight and in the physical comfort of the babies. In a few instances a relapse occurred following an apparent clinical cure of the infection, and sulfapyridine treatment was again instituted. Corneal complications were not observed during the treatment.

Even though the advent of sulfonamides has apparently revolutionized the treatment of ophthalmia neonatorum, local treatment for this condition with irrigations of saline, atrophine drops, and paraffin instillations has not been discontinued. The present series comprises a total of 322 patients, 273 of whom were treated with sulfapyridine. A control group of 46 patients were treated by the classical method of local therapy. HENRY C. FALK, M.D.

GENITOURINARY SURGERY

ADRENAL, KIDNEY, AND URETER

Strickler, C. W., Jr.: Pheochromocytoma; Operative Failure. Case Report. *South. Surgeon*, 1942, 11: 193.

The patient, a male aged thirty-two years, described attacks characterized by severe headaches for fifteen or twenty minutes' duration, and dizziness, shortness of breath, pounding of his heart, substernal pain, nausea, vomiting, and sweating. The latter symptoms would persist for from one to two hours. These attacks occurred in the morning shortly after arising and by afternoon the patient felt well and normal. On April 1, 1941, the patient had the usual attack which had apparently subsided. At about 10 o'clock on this morning he started with jerking of the middle and ring finger of the right hand. This was followed immediately by jerking of the entire body and loss of consciousness and frothing at the mouth. He was told there was marked rigidity of the entire body. Unconsciousness persisted for nearly two hours and on regaining consciousness there was severe headache and generalized weakness associated with motor disturbance in the right arm and leg. He was admitted to a hospital in a state of unconsciousness and his blood pressure was found to be 240 at that time. Examination revealed a well developed and nourished male. The eyes were normal except for a slight suggestion of exophthalmus. Examination of the heart revealed slight enlargement in the region of the left ventricle. There was a systolic blow over the entire precordium of moderate intensity, but it was heard best over the pulmonic area. The abdominal examination was negative.

Routine examination of the urine revealed from 0 to 2+ albumin, 0 to 3 red blood cells, and positive sugar. Routine examination of the blood revealed 5,336,000 red blood cells with 98 per cent hemoglobin. There were 10,900 white blood cells with 4 per cent bands, 67 per cent segmenters, 5 per cent eosinophils, 20 per cent lymphocytes, and 4 per cent monocytes.

A basal metabolism taken May 24, 1941, was +74 and another taken May 28, 1941, was +41. The glucose tolerance test revealed a fasting blood sugar of 283 mgm. per cent with a 1+ urine sugar. At the end of one-half hour the blood sugar was 326 mgm. per cent with a urine sugar of 2+ and at the end of one hour the blood sugar was 380 mgm. per cent with a 3+ urine sugar. The blood cholesterol was 287 mgm. per cent, the nonprotein nitrogen was 36 mgm. per cent, and the creatinin was 1.4 mgm. per cent.

A tentative diagnosis of pheochromocytoma was made and the patient had retrograde pyelograms made. Studies of the left side were normal. The pyelogram of the right revealed the pelvis to be slightly dilated, the minor calyces were blunted, and there was slight displacement of the kidney inferiorly.

While these studies were being completed the author had the opportunity of observing the patient on many occasions during an attack. On awakening in the morning at 6 a.m. the blood pressure was usually 130 systolic over 85 diastolic. After beginning the routine of the hospital in the morning, his blood pressure would gradually rise. On one occasion the systolic pressure was over 330. As the blood pressure would rise the patient would complain of severe headache, dizziness, substernal pain, shortness of breath, nausea, and pounding of the heart. In addition to these symptoms a slight increase in exophthalmos was noted and the patient developed a heliotrope cyanosis, affecting especially the face, hands, and feet. The cyanosis would alternate with pallor and this was noted particularly as circumoral pallor. Diaphoresis was profuse. The respiratory rate during these attacks averaged about 28 per minute and the pulse rate about 80. By 10 or 11 o'clock in the morning the patient was usually quieting down from all of these symptoms, and by about 10:30 the blood pressure would begin to fall.

With these facts in mind it was the author's impression that the patient had a pheochromocytoma of the right adrenal body. He was, therefore, operated upon. A high loin incision was made and the twelfth rib removed. Because of the known profound shock suffered by these patients with any minor or major surgical procedure and because of certain physiological disturbances which may take place, the patient was prepared by the injection of natural and synthetic hormones from the adrenal body beginning three days before the operation. In addition, he was given large quantities of salt in his liquids. During the course of the operation the patient received 600 cc. of plasma and large quantities of saline and glucose solutions. He also received the natural and synthetic hormones from the adrenal body and numerous injections of adrenalin in oil subcutaneously. Full doses of ouabain were used in the emergency which followed. Immediately on clamping the pedicle of the tumor, which was located in the right adrenal body, the blood pressure fell precipitately to 95 over zero. Further drop may have occurred except that the patient was immediately given epinephrine intravenously, and between 10:40 in the morning after clamping of the pedicle, and 8:25 in the evening at which time the patient died, he had received a total of 17.4 cc. of 1:1000 epinephrine intravenously and 5 cc. of adrenalin in oil subcutaneously. Even with these huge quantities the blood pressure never was above 100 systolic. Death occurred eight and one-half hours after the operation was completed and seemed to be the result of shock and respiratory failure. Respiration stopped fifteen minutes before the heart stopped beating.

Pathological report of the tumor revealed an egg-shaped, perfectly encapsulated mass measuring 9 by 5 cm. and with a total weight of 146 gm. A small piece of corticoadrenal tissue was found attached which measured less than 1 cm. Grossly the cut section showed an outer rim of tissue varying from 1.5 to 3 cm. thick. The cells appeared to be arranged radially in this layer. The core of the tumor was fairly firm, grayish white, and somewhat translucent in appearance. The outer rim was yellowish-orange in color. JOHN A. LOEF, M.D.

Sargent, J. C.: Basic Principles Governing Conservative Surgery in Hydronephrosis. *J. Urol.*, 1942, 47: 323.

There are questions concerning the surgical correction of hydronephrosis that are still dubious and challenging: such as, questions of the recoverability of function, of the control of infection, of basic principles of procedure, of surgical technique, and of long-term prognosis.

Were hydronephrosis truly the unilateral lesion that it ordinarily is taken to be, there would be little point whatever to this subject. The surgical removal of a hydronephrotic kidney ordinarily is extremely simple and safe and the clinical relief that follows is immediate and complete. Why would one even consider pyeloplastic surgery with a perfectly sound kidney on the opposite side?

It is true that hydronephrosis usually presents a clinical picture that is clearly unilateral. Even the x-rays and the other cystoscopic evidence ordinarily point to trouble in only 1 kidney. With it are to be found quantities of residual urine, often infected. Function is measurably lessened. The pelvis looms large, and its calyces are ballooned and blunted. Comparison with the opposite kidney is most striking and the impression of unilaterality is quite impelling.

A more critical study, however, often tells a different story. Commonly the other kidney, too, is slightly oversize, with the junction of ureter and pelvis marked by an abruptness which is clearly not normal.

Practically all ureteropelvic obstructions owe their existence to 1 of 2 anatomical vagaries, either the external pressure of an anomalous blood vessel or the intrinsic narrowing of an anomalous fibromuscular atresia. And anomalous blood vessels and anatomical narrowings, like extra fingers, tend strongly to be bilateral.

Clinicians long have noted the frequency with which pain develops in the remaining kidney within a few years after one kidney has been removed for hydronephrosis. In a case of well developed unilateral hydronephrosis of the type discussed the hydronephrotic kidney still maintains an average daily output of about 1,000 cc. of urine despite its obstruction, while the normal kidney maintains its daily average output of about 1,500 cc. of urine. Following the removal of the damaged kidney it is found that the total volumetric output of urine does not drop to the 1,500 cc. level that the 1 good kidney maintained before surgery. On the contrary, that kidney steps up its efforts to maintain the 2,500 cc. output that both had done before. Any slight narrowing of its ureteropelvic juncture, however unimportant heretofore, may now suddenly prove to be embarrassing. While it may have been ample to permit 1,500 cc. of urine to pass daily without the slightest embarrassment, 2,500 cc. prove to be too much for the narrowed lumen to clear without building up an abnormal pressure behind it and starting pelvic expansion. Nephrectomy for a seemingly unilateral hydronephrosis, rather than being a simple, safe means of restoring the patient's health, can and sometimes does set off a hydronephrosis on the opposite side that is progressive to the point of new and even more alarming symptoms.

When large quantities of residual urine remain trapped within an enormous hydronephrosis, the ordinary functional dye tests usually are quite worthless for the estimation of renal damage. It is here above all other places that the excretory urogram finds its greatest usefulness as an indicator of renal function. In the earlier films of a set of excretory urograms in advanced hydronephrosis, one is likely to see only a puddle of opaque media accumulating here and there within the rounded dilated calyces. Nothing like a full outlining of the entire kidney cavity occurs until an hour or two after the drug has been administered. However, the very presence of these puddles of opaque media is proof positive that the kidney retains some function, and especially if the medium is noted appearing rather promptly one dare not take the incomplete outline of the enlarged kidney pelvis as an indication of worthless function.

It is frequently astounding to note the degree of functional recovery that a hydronephrotic kidney of this sort will display. An extremely high insertion of the ureter led the author to perform complete ureteropelvic neostomy, and then with ureter and pelvis separated, most of the redundant pelvic wall was resected before the new union was made. Long-standing pain, sizable residue, haziness of urine, and reduced function were present. Following operation the amount of residual urine in the pelvis dropped to less than half of an ounce. With better drainage, infection decreased to the point where the urine became crystal clear although there still were some pus cells and cocci. With the depressing effects of back pressure and of infection thus relieved, function recovered materially. Not only was there a notable increase in the ability of the kidney to excrete urographic media, but on 2 separate occasions a good concentration of methylene blue was found to be appearing at the ureteral orifice without unreasonable delay after injection; and all of this occurred in a large hydronephrotic kidney in which nothing but a little puddling of opaque media was seen here and there on the fifteen-minute preoperative film.

Because of this and several other similar cases the author states that he is skeptical concerning Hinman's theories concerning renal counterbalance, es-

pecially his theory that a handicapped kidney is required to compete with a normal mate and is doomed to ultimate functional death, regardless of what may be done to save it. He is completely confident, however, that a hydronephrotic kidney, successfully repaired by plastic surgery, recovers function far better if it is spurred to the task, so to speak, by a poor or absent kidney on the other side.

He presents some data concerning a case of bilateral hydronephrosis which was operated on in 1925 and is still under his regular observation. Upon admission to the hospital, the patient, a young man, was desperately ill with that classic combination of uremia and sepsis so familiar to us all. Bilateral pyelograms were made by injection through the nephrostomy tubes six weeks after a left nephrostomy had been done as an emergency measure, and ten days after a pyeloplasty with protecting nephrostomy had been done on the right side.

With hydronephrosis so advanced and with renal function so completely gone, either of these 2 kidneys would have been removed if its mate had been at all normal. The situation left no choice, however, but to establish permanent nephrostomy drainage or, if at all possible, attempt some plastic repair. Even though the patient's general condition improved greatly following the original emergency left nephrostomy, when the right pyeloplasty was undertaken and again months later when the left plastic operation was performed, his total renal function was so seriously impaired that the author did not care to risk the danger of disrupting the quite elaborate collateral circulation that had developed within the perirenal fat. On each side, without lifting the kidney from its bed, he worked down behind the lower part of the enormously enlarged pelvis and simply joined the ureter and pelvis by a lateral window anastomosis at a point conveniently low for good drainage.

The right kidney proved to be the poorer of the 2 so far as recovery of function was concerned. A simple lateral ureteropelvic anastomosis was employed. Ten years after pyeloplastic release, quantities of residual urine still remained within the badly dilated pelvis. The urine too, continued cloudy and infected. All pain was gone, however, and chills and fever no longer occurred. Most important of all, the patient's general health had returned in a manner almost unbelievable and now, sixteen years after his nearly fatal illness, he is a hard-working factory mechanic who could lick his weight in wild cats. The recovery in renal function that these ten years of improved drainage brought is worthy of note. Readings made from urine carefully aspirated from the renal pelvis proved that a 35 per cent elimination of phthalein occurred within an hour's time, something indeed for a man who at one time had hovered for days in profound uremia.

From the very beginning of this study certain striking questions projected themselves concerning the dynamics of the renal pelvis after operation. Assuming that back pressure were successfully released, would the dilated pelvic wall merely collapse or would it actually shrink? Would anatomical involution of the more solid structures forming the renal calyces occur, and to what extent? Upon the answer to questions such as these must rest the solution to the more practical problem of the clinical worth of efforts at surgical correction of long-standing obstruction at the ureteropelvic juncture. In illustration of this the author presents the preoperative and the six-year postoperative retrograde pyelogram in the case of a young man having an advanced dilatation of the right upper tract caused by compression of the lower ureter by an enormous tumefaction of the other kidney congenitally misplaced in the bony pelvis. With the mass removed and the pressure on the lower ureter released, anatomical involution was progressive until six years later when the ureter was found completely normal and the renal pelvis also, except for some persistent redundancy of its leathery extrarenal wall.

When long-term postoperative studies are made after pyeloplastic correction of well advanced hydronephrosis, one is sometimes startled beyond belief to find the degree to which this involution occurs. The comparative pyelograms are presented (in the original article) in the case of a young man suffering from attacks of left renal pain for some two years. The preoperative thirty-minute intravenous urogram showed the enormous proportions of the left hydronephrosis that was discovered. The very concentration with which the drug was excreted, however, indicated that the kidney retained some worthwhile function. Moreover, a faint suggestion of hydronephrosis in the opposite kidney argued strongly against nephrectomy in such a young man and conservative surgery was undertaken. A single anomalous vein was found producing sharp angulation with obstruction at the ureteropelvic juncture. However, it was apparent that distortion of the anatomy was too extensive to be corrected by mere severance of the vessel and that some plastic procedure had to be done. In this particular instance a simple Mikulicz type of correction proved best suited for the job and consequently none of the redundant pelvis was removed. The thirty-minute intravenous urogram made thirteen months after operation and the retrograde pyelogram made still a year later both showed the almost unbelievable anatomical involution that had taken place once free pelvic drainage had been re-established.

With due allowance for difficulty of completely emptying a pelvis by ureteral catheter suction, this discrepancy between the measured amount of residual urine and the vital capacity of the pelvis was too definite a thing not to have been real.

JOHN A. LOEF, M. D.

Ballenger, E. G., and McDonald, H. P.: Conservation of the Hydronephrotic Kidney. *J. Urol.*, 1942, 47: 203.

Obstructions at the ureteropelvic outlet cause a number of more or less misleading symptoms. The

main symptom is a feeling of discomfort, fullness, or pain in the affected side. The pain varies from a dull ache to severe attacks of renal colic. The affected side usually has a more or less constant soreness or tenderness. Frequently the attacks of severe pain associated with fever are recurrent. The pain is often worse after standing or after a long automobile ride. Abdominal gas, indigestion, and nervousness are other common symptoms.

Diagnosis of obstructions at the ureteropelvic juncture is relatively simple if the symptoms are taken into account and if a ureteropyelogram is made. It is well to suspect such obstructions in patients with long-standing pain in the kidney region. Ureteropyelograms should be made in both supine and upright positions. A large number of urologists in making a pyelogram pass the catheter into the renal pelvis as the first step. After injecting the pyelographic medium and making the pyelogram, some pull the catheter down and make another picture. A great many do not make upright films as a routine. A better method for complete visualization of the ureter and pelvis which the authors have employed for a good many years is as follows:

The ureteral catheter is inserted 4 or 5 cm. up the ureter and 15 per cent sodium iodide or 50 per cent skiodan is injected. The mouth of the ureter is observed during the injection and the catheter is inserted farther up the ureter if the medium runs back around the catheter. The injection is continued slowly and until the patient experiences slight pain or fullness in the side. The film is then made. Another film is made in the upright position, care being used to have the ureter as well as the pelvis slightly distended with the medium. Occasionally it has been found necessary to insert the catheter all the way into the pelvis and drain off the urine before injecting the medium. The important point is to secure a ureterogram as well as a pyelogram and to make an upright film with the end of the catheter at least half way down the ureter. Satisfactory ureteropyelograms are not obtained when the catheter is all the way up the ureter. The catheter sometimes acts as a stylet and straightens the ureter while the unsplinted ureterogram may show obstructing kinks. Failure to make an upright film may prevent the effect of nephroptosis from being seen. The downward excursion of the kidney often plays a role of major importance in producing the obstruction. This is true especially of anomalous vessels or fixation of the upper ureter.

It goes without saying that obstructions in the lower part of the urinary tract should receive proper attention. Ureteral dilatation is usually of no value in relief of obstructions at the ureteropelvic juncture. When study of the ureteropyelograms indicates that obstruction is present at the ureteropelvic juncture and is causing hydronephrosis or pain an operation should be considered.

The operative procedure should be directed toward relief of the obstruction, removal of the redundant pelvic sac, and fixation of the kidney when ptosis is present. The greatest single factor in the success of plastic reconstruction of the renal pelvis is adequate relief of the obstruction. Second in importance to proper care of the obstructive lesion is prolonged drainage of the pelvis and splinting of the upper half of the ureter. This may be done by nephrostomy and the use of an indwelling ureteral catheter. It is better done by a combination nephrostomy drainage tube and ureteral splint devised a few years ago by Robert B. McIver.

The type of operation needed depends upon the nature of the obstructing lesion at the ureteropelvic juncture and the size of the hydronephrotic sac. The ureter is freed completely and all bands and adhesions are divided. Anomalous vessels usually should be divided unless by so doing more than 20 per cent of the kidney seems to be affected thereby. Reimplantation of the ureter in front or behind the obstructing vessel is preferable to division of large arteries. As regards the narrowing at the ureteropelvic juncture, the "Y" plasty or Schwyzer method of relieving obstruction is used when the shape of the pelvis and the obstruction lends itself to this type of procedure. The Heineke Mikulicz principle, first used by Fenger in ureteral strictures, has been successful in most of the authors' cases. Lateral anastomosis of the ureter with the pelvis is the plastic procedure of choice whenever the insertion of the ureter is high in the pelvis. Removal of the excess pelvic sac and suture of the edges has been carried out as a rule with good results. If the operation is unduly prolonged by this step, however, it should be omitted since good functional results have been obtained when no attempt was made to do more than relieve the obstruction.

Fixation of the kidney has been done almost as a routine measure. A strip of lumbar fascia is plicated just under the capsule of the lower pole of the kidney. This holds the kidney up and tends to pull the lower pole outward, which facilitates drainage of the pelvis. The drainage tube and ureteral splint are left in for two weeks or longer, according to the amount of infection present. JOHN A. LOEF, M. D.

Kjølhede, K. T., and Lassen, H. K.: The Significance of Randall's Papillary Lesions in the Causation of Renal Calculi. *J. Urol.*, 1942, 47: 45.

On the basis of their results in a study of 135 cases at necropsy, the authors conclude that Randall's papillary lesions are not new pathological entities. They review Randall's work on calcium deposits in the papillae of the kidney and his theory as to the genesis of urinary calculi in detail. In 86 of 135 subjects studied, several kinds of deposits of calcium salts were noted in the kidneys. In 14 instances calculi were discovered in the kidneys, but only once did a papillary deposit of calcium salt seem to have contributed to the development of a co-existing calculus.

Since calculi are found in kidneys without such deposition, the authors believe that deposits of cal-

cium salt cannot be of essential significance in the genesis of calculi. In 4 of their cases, a stone was found attached to the mucous membrane of a calyx outside of the renal papilla, but which had not developed from deposits of calcium there. Such deposits, however, are now and then encountered in the mucous membrane of a calyx.

The deposits found occurred independently of such factors as sex and age and also seemed to bear no relation to diseases of the gastrointestinal tract, liver, or circulatory system. They were, however, encountered relatively often in association with arteriosclerosis, infection, or stasis in the kidneys examined.

The authors draw the conclusion that a deposit of calcium salts at best can represent only a focus of lowered resistance in the development of renal calculi; more often such calculi are the result of wholly different factors. ARTHUR H. MILBERT, M.D.

Lindner, H. J., and Atcheson, D. W.: Sulfathiazole Crystallization in the Kidney. *J. Urol.*, 1942, 47: 262.

It is generally recognized that sulfathiazole has a tendency to precipitate and form crystals in the urine, but the extent to which this may occur is probably not realized. In this era of sulfonamide therapy, in which a new product is introduced every few months, it is difficult to become fully acquainted with the shortcomings and qualifications of one drug before another is supplanting it. Much has been written about calculus formation associated with sulfapyridine therapy but relatively little regarding the urinary concretions occurring with the use of sulfathiazole. At present, there are no more than a dozen reports in the literature of this occurrence, scarcely enough to impress the average reader with the seriousness of certain complications which may occur with the use of sulfathiazole.

Two cases described in this article illustrate how extremely serious these complications may be, and lead to the following conclusions of the author:

The use of sulfathiazole may lead to very serious kidney sequelae and one should always be alert to detect these when the drug is used. The urine should be checked daily as to volume of intake and output, hematuria, crystals, albuminuria, and casts.

Sulfathiazole is rapidly excreted in the urine and tends to precipitate, especially if the urine is acid.

When the drug is used, care must be taken to see that sufficient fluids accompany it.

The blood sulfathiazole level does not indicate the degree to which the crystals are precipitated.

The sulfathiazole concretions are not radiopaque.

The crystals tend to produce multiple hemorrhages throughout the kidney parenchyma and mucosal linings. These may even be of advanced degree with massive destruction of the parenchyma.

The crystals may produce anuria by mechanical block in the ureters, but it is more likely that the serious blocks are those which occur in the tubules. Lavage with the removal of the lower block will lead to increased urinary output up to a certain point.

The best therapy at present is kidney lavage with warm water by means of ureteral catheters, supplemented by the forcing of fluids, alkalization, and heat. JOHN A. LOEF, M.D.

Priestley, J. T., and Schulte, T.L.: Simultaneous Bilateral Operation for Renal and Ureteral Calculi. *J. Urol.*, 1942, 47: 255.

Approximately 85 per cent of the patients who have renal or ureteral calculi which require surgical treatment have stones in one side of the urinary tract only. In the remaining 15 per cent of cases bilateral calculi are present, and consequently a more serious situation exists. As a rule, when bilateral stones which require surgical removal are present, they are dealt with in two distinct operations.

In general, there seem to be two main types of cases in which a bilateral simultaneous operation may be considered; namely, the case in which the patient is in good condition with normal renal function and a readily removed calculus on each side; and, in contrast, the case in which the patient is critically ill with serious calculous disease which jeopardizes his well being in each kidney or ureter and either side by itself would demand immediate surgical attention. However, when a serious condition of this type exists simultaneously in each kidney or ureter, this does not seem an adequate reason to treat one side immediately and postpone attention to the other for a matter of ten days or two weeks. The obvious advantages of simultaneous bilateral operation, in addition to relieving an acute condition on both sides, are largely economic.

During the last several years bilateral simultaneous operations on the urinary tract have been performed for stone in 5 cases without death. Although definite indications for this type of surgical treatment may be limited, it appears as though there are certain cases in which it may be most useful. It seems possible that the field of usefulness of simultaneous bilateral operation for some is somewhat wider than we have generally realized.

Johnson, C. M., and Smith, D. R.: Benign Polyps of the Ureter. *J. Urol.*, 1942, 47: 448.

The authors report a single case of benign polyps of the upper ureter which makes the fiftieth such case reported in the literature. The disease occurs more commonly in the male, usually in the fifth or sixth decades, with an equal incidence in either ureter, although the lower portion is more often affected. The neoplasm is usually papillomatous and occasionally polypoid. The most common signs are hematuria, renal tumor, and kidney pain. None of these signs are pathognomonic; the hematuria arises from the tumor, the pain from ureteral irritation due to the passage of blood clots, and the tumor mass is the hydronephrotic kidney. Clinical diagnosis is limited to the demonstration of a filling defect in the ureteropyelogram; however, this finding has been accomplished in less than 15 per cent of the reported cases.

The authors' case is that of a twenty-four-year-old male medical student who had suffered recurrent renal pain since the age of six and since seventeen had noticed an associated hematuria. Seven years prior to the diagnosis of ureteral tumor the patient had been operated upon for urolithiasis, but since no stone had been evident a nephropexy was done. The accompanying relief was short-lived and in two years the attacks reappeared. The authors demonstrated a filling defect in the upper ureter and performed a nephrectomy and partial ureterectomy. The surgical specimen revealed a markedly hydronephrotic kidney and polyps at the ureteropelvic junction. The polyps measured from 10 to 12 mm. in length, respectively, and 4 mm. in diameter, and were smooth, pale, and soft. They resembled those so often seen in the nasal passages. Microscopic tissue examination revealed the polyps to be lined with mucosa typical of the ureter with some papillary projections due to the piling up of cells, and the underlying tissue was composed primarily of loose bundles of smooth muscle and connective tissue with some round cells and capillaries, but no mitotic figures. The authors considered the polyps congenital in origin and responsible for the pyelectasis.

ROBERT LICH, JR., M. D.

BLADDER, URETHRA, AND PENIS

Conway, J. F., and Broders, A. C.: Submucous Extension of Squamous-Cell Epithelioma of the Urinary Bladder. *J. Urol.*, 1942, 47: 461.

The authors studied the extension of squamous cell-epithelioma of the bladder; they first reviewed the existing literature and then reported their findings in both surgical and autopsy specimens. A total of 40 specimens were studied: 22 surgical and 18 autopsy. From this study there were presented facts for a more logical treatment of bladder tumors.

No relationship was discernible between the grade of the tumor and the age of the patient. Of the lesions studied from surgical material 77 per cent were of Grades 3 and 4, while the autopsy specimens presented only 44 per cent of similar grades. Tumors of Grade 1 presented 1 cm. extension in 20 per cent; Grade 2 in 40 per cent; Grade 3 in 71 per cent; and Grade 4 in 36 per cent. The authors have no explanation for the diminished percentage extension in lesions of Grade 4; however, these figures demonstrate that "submucous extension is common in malignant lesions of high grade."

Two cases are presented in which peritoneal extension was present with only slight lateral extension. The tumors were of Grades 3 and 4.

Two cases are discussed in which tumor cells were found in the submucosa and the overlying mucosa was perfectly normal. These tumors were of Grades 3 and 4 and the patients died within three years after operation.

Metastases were found in 15 per cent of the series of 40 cases studied. The organs most frequently involved were the liver and lungs. In 13 cases in which metastases were mentioned at operation they were found in the order of frequency at the base of the bladder, in the lateral walls, the posterior walls, and the anterior walls. The incidence of metastases in the surgical specimens was 27 per cent as compared to 50 per cent in the autopsy series.

Lesions were found *in situ* in 14 per cent of the operated cases and 33 per cent of those seen at autopsy. "All growths encountered in this group were the same grade as the gross tumor." These lesions were found from 1 to 5 cm. from the gross tumor and showed no relationship between the grade and extension from the site of the original tumor.

Of the 22 surgical cases in this series 16 were available for follow-up. In 44 per cent of these cases the malignancy was Grade 4, in 44 per cent Grade 3, in 6 per cent Grade 2, and in 6 per cent Grade 1. Eight patients (50 per cent) died within a year of operation (3 had Grade 4 malignancy, and 5 Grade 3). Eleven of the 16 cases were treated with segmental resection of the bladder and 2 patients are known to be living without recurrence after three years. In 5 cases a total cystectomy was done and 4 of the patients died within a year after surgery. The authors point out that these figures do not recommend cystectomy, but point out that these cases were not "suitable for total cystectomy."

The authors concluded that their study revealed the following information in so far as the treatment of vesical neoplasm is concerned:

If segments of the bladder are to be removed at all, they should be removed only (1) when roentgenological examination of the thorax rèveals no abnormality which could be interpreted as metastases; (2) when preoperative information was derived from cystoscopic examination, cystography and intravenous urography indicate that the growth is still confined to the bladder; and (3) when thorough exploration of the liver, peritoneum, and regional lymph nodes reveals no abnormality which is suggestive of metastasis.

It is further pointed out that when segments of the bladder are removed, the edges should be inspected for extension of tumor tissue and if found the operation is of prognostic value only for an account of the problem of disposition of the ureter at such a stage in the operative procedure, the ideal time for total cystectomy has passed. It is the authors' belief that in the event of tumors of Grades 3 and 4 and possibly 2, a total cystectomy is the treatment of choice with transplantation of the ureters to the bowel, except in such cases in which the previously quoted reservations for partial resections may be fulfilled.

ROBERT LICH, JR. M. D.

GENITAL ORGANS

Macpherson,. I: Ureterocele with Prolapse Through the External Urinary Meatus. *Brit. J. Surg.*, 1942, 29: 294.

The author presents a rather interesting case of prolapsed ureterocele which protruded through the

external meatus. This was treated surgically and a ureterocele involving the opposite ureteral orifice was then noted. This, too, was treated surgically and a good result obtained. J. SYDNEY RITTER, M. D.

Fowler, H. A.: Prostatic Obstruction in Young Adults. Report of 5 Cases. *J. Urol.*, 1942, 47:16.

That obstruction due to prostatic hyperplasia may, and does, occur in young men is attested to by the author's report of 5 cases within a period of eighteen years. The youngest subject was nineteen, the oldest twenty-six years of age. Clinically, these cases presented in varying degrees the characteristic symptoms of prostatism; difficulty in voiding, delay in starting, a small stream, frequency, urgency, dysuria, overflow incontinence, or complete retention of urine. In 3 cases, gross enlargement of the prostate was found rectally. The diagnosis was confirmed cystoscopically in 4 cases, and in the fifth case it was impossible to enter the bladder with any urethral instrument.

A careful history will show disturbances in urination far antedating the onset of the immediate illness. Often the lesion dates back to infancy. Milder degrees of obstruction are confused with other conditions, and often the patients are treated for varying periods of time with internal medication, prostatic massage, urethral dilatation, and topical applications to the deep urethra with indifferent results. It is only when the symptoms of prostatism become very clear that further investigation is made, and cystoscopy then reveals the true nature of the condition.

Five case studies are presented; they gave histories which followed the pattern of prostatic obstruction in the aged. From these cases the author noted the relatively slight anatomical changes in the prostate gland which are capable of producing such marked functional disturbances and which give added proof that the size of the gland bears no constant relationship to the degree of functional impairment.

Pathologically, a significant finding was hyperplasia of the muscular elements with very slight epithelial increase. In this connection, the work of Deming is recalled, wherein the initial phase of prostatic hypertrophy was shown to be the development of a fibromuscular mass from the intramuscular stroma in the wall of the posterior urethra, and invasion from the periphery of the fibromuscular nodule by epithelium of a prostatic duct was secondary. It is therefore suggested that herein may lie an explanation for at least 2 of the author's cases, in which the condition appeared to be the earliest phase in the development of benign prostatic hypertrophy. Certain cases of Marion and Moore are cited in this connection.

The role of hormonal influence in prostatic enlargement is briefly reviewed, with reference to Lower's work at the Cleveland Clinic, Cleveland, Ohio. The author cites a case report by Powell of the occurrence of prostatic enlargement in a boy of seventeen years, following intensive therapy with anterior pituitary-like gonadotropic preparations. He concludes that in order to account for prostatic enlargement in young adults one must assume that the hormone imbalance is due to some factor or factors other than the occurrence of changes incident to the male climacteric (possibly of congenital origin), and that the condition may become operative at any age. ARTHUR H. MILBERT, M. D.

Friedman, H. H., and Grayzel, D. M.: Myomatous Tumors of the Epididymis. *J. Urol.*, 1942, 47: 475.

The authors review the literature on 12 cases of myoma of the epididymis and report 1 case of their own. According to the literature, the condition is a disease of the fifth and sixth decades and no definite predisposing factor has been ascertained. The gradual, painless increase in size of the scrotal tumor appeared to be quite general. On occasion, the victim complained of intermittent scrotal and back pain. The tumor was usually found to be stony-hard, round, ovoid, or nodular, but not tender. In 7 of the 13 cases it was associated with a hydrocele. The diagnosis was never made preoperatively and usually the growth was considered a testicular tumor. Most frequently the tumor replaced the globus major or minor, rarely the corpus, of the epididymis.

The pathogenesis of the tumor is disputed, but the authors consider its origin to be in the smooth muscle cells which are normally found in the epididymis. Grossly the tumor is firm, gray or pink, round, ovoid, or nodular, and well encapsulated. The cut surface of the tumor resembles that of a uterine fibroid with interlacing bundles of gray and white fibers arranged in whorls. Microscopically the tumor is composed of smooth muscle cells with a varying admixture of connective-tissue elements and, occasionally, glandular structures. Lymphocytic infiltration may be observed.

The case reported was that of a fifty-seven-year-old white male with a progressively increasing scrotal tumor of four months' duration. Examination revealed a stony-hard globus major of the left testicle which was four times normal in size. The cord was thickened and the lower portion of the tumor was transilluminated. After the diagnosis of testicular malignancy was made, the patient was operated upon. The left testicle and a portion of the cord, which weighed 108 gm., were removed. The yellow-brown testicle was histologically normal and measured 5 by 3.5 by 3 cm. No epididymis could be made out; in its stead was found a firm, lobulated, gray tumor measuring 5.5 by 4.5 by 3 cm., the cut surface of which presented the picture previously described for myoma of the epididymis. Microscopic examination revealed the epididymal tumor to be composed of "interlacing bands of collagenous, fibrous connective tissue enclosing groups of large irregularly polygonal or spindle-shaped cells with distinct borders and vesicular oval nuclei." The cells stained yellow-brown with the Van Gieson method, while the collagenous bundles stained a deep pink. It is of

interest that these tumors have not been known to undergo malignant changes.

ROBERT LICH, Jr., M.D.

O'Brien, M. G.: Primary Sarcoma of the Epididymis. *J. Urol.*, 1942, 47: 311.

The author reports a case of primary carcinoma of the epididymis with metastasis to the chest and skull.

He reports that the patient was admitted on July 10, 1940, with a history of having sustained an injury to the left testicle in 1932. The present illness began December 23, 1939, when he was again injured in the left testicle. The testicle remained swollen for ten days and then returned to normal.

On July 15, 1940, an epididymo-orchiectomy was done and a fibrous sarcoma involving the tunica vaginalis and epididymis was found. On July 24, 1940, the patient was discharged from the hospital with negative x-ray findings relative to metastases. Six weeks later x-rays showed metastasis in three ribs. The patient had had x-ray therapy prior to this. Death occurred three months after operation and only ten months after date of the injury. There were extensive metastases through the perirenal glands.

The author concludes his paper as follows: Primary malignant tumors of the epididymis are rare. There are, inclusive of the present report, only 92 cases recorded.

The role trauma plays in the causation of tumors of the epididymis and testicle, a subject of controversy, is significant. The train of events in the writer's case, as well as in those of others, justifies this opinion.

In all cases of scrotal or testicular injury the patient should be kept under prolonged observation. In the case above considered, a fibrosarcoma developed within six months following a violent blow to the scrotal region.

Bone metastases may occur to an unpredictable degree. The usual sites of localization are the lumbar vertebrae, and to a lesser extent, one or more distant bones. In no case was there such rapid and widespread dissemination as occurred in this instance.

After reading the author's presentation, a recapitulation of the cause of death plus his conclusions is worthy of mention. J. SYDNEY RITTER, M.D.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

CONDITIONS OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Herrmann, L. G., Reineke, H. G., and Caldwell, J. A.: Post-Traumatic Painful Osteoporosis. A Clinical and Roentgenological Entity. *Am. J. Roentgenol.*, 1942, 47: 353.

Roentgenograms are indicated whenever post-traumatic pain in an extremity persists. Post-traumatic osteoporosis is frequently overlooked. If left untreated it may result in permanent disability because of ankylosis of one or more joints. Early recognition of the disease is necessary for its successful treatment.

Post-traumatic osteoporosis is a disease entity which is characterized by definite roentgenological changes in the three main stages of its evolution. It must be distinguished from the less serious atrophy of the bone which normally results from temporary disuse. True osteoporosis may be recognized by:

1. Partial loss of motor function of the affected part.
2. Mild to severe vasomotor and trophic changes in the affected extremity.
3. Spotty demineralization of the bones near the site of trauma.
4. Mild to severe aching pains in the extremity greatly out of proportion to the local signs of injury, which cannot be relieved by immobilization of the affected part.

Osteoporosis most frequently occurs in the carpal and tarsal bones. The next most frequently involved are the epiphyses of the metacarpals and metatarsals, the phalanges, and then the epiphyses of the long bones. Post-traumatic osteoporosis may also occur in the flat bones of the skull.

There are two apparently distinct phases indicated by the roentgenograms. In the early acute form, irregular rarefied areas in the spongiosa result in a mottled appearance of the carpals, tarsals, and heads of the metacarpals and metatarsals. Later, the cortex of the small bone is thinned which gives an ill-defined homogeneous appearance to the bones. In the chronic phase reorganization occurs and the limits of the individual bones again become evident as recalcification progresses. The onset of the disease is relatively rapid, but the reconstructive stage usually is extremely slow, and recovery of function may require many months while extensive fusion of the carpals or tarsals frequently occurs. In most cases complete recalcification never occurs.

Until recently, the treatment has been symptomatic and preventive rather than curative in nature. Heat, massage, heliotherapy, exercise, thyroid and parathyroid extracts have all been used. Roentgen therapy as recommended by Mumford has been tried, but while it diminishes pain it does not shorten the period of disability nor check the demineralization of the bone. Intensive physical therapy as suggested by Gurd gives results comparable to those obtained by roentgen therapy. No improvement results from sympathectomy or ramisection. However, the authors report that the course of the disease has been greatly shortened, and most of the serious complications have been avoided by early recognition in the acute phase and treatment by the thorough denudation of the main artery to the affected extremity. Patients thus treated by periarterial sympathectomy were able to resume work in three months on an average, while those in the control group treated by physical or roentgen therapy, or other conservative means, required nine months to regain complete control of function.

The authors attribute the striking beneficial results which follow periarterial sympathectomy in the treatment of post-traumatic painful osteoporosis to the interruption of abnormal trophic reflexes which course along the nerve tissues in the adventitia of the large arteries of the extremities. These neurotrophic fibers have been shown to be segmentally distributed to the periarterial network from the peripheral somatic nerves. Since they do not course through regional sympathetic ganglia, sympathectomy and ramisection fail to improve post-traumatic osteoporosis, while striking improvement results from the denudation of the major artery to the affected part. SAMUEL B. SPIRA, M.D.

Olmedo, R. F., and Díaz Roig, S.: Bone Lesions in Gaucher's Disease; Consideration of a Case (Lesiones óseas en la enfermedad de Gaucher; consideraciones sobre un caso). *Rev. de ortop. y traumatol.*, 1942, 11: 182.

The authors recapitulate the main features of Gaucher's disease and recall that Logan (SURG., GYNEC. & OBST., 1941, 72: 807) stated that bone symptoms occur in 50 per cent of the cases, while Hofman and Makler have mentioned an incidence of 22 per cent. The osseous manifestations appear especially in the epiphyses and metaphyses of the long bones of the lower extremities, and in the pelvic bones: macroscopically, the bone is thickened, and this becomes particularly evident in the distal part of the femur which assumes the shape of a champagne bottle or of an Erlenmeyer flask. Spontaneous fracture is infrequent, except when the lesion involves the femoral neck or the vertebral bodies. Roentgen examination shows swelling of the bone without periosteal reaction, thinning of the cortex by internal erosion, and rarefaction of the spongiosa with formation of clear zones which may simulate chronic osteomyelitis when pain is present at the same time.

The authors report a case which was diagnosed in a boy at the age of nine years and was treated by splenectomy. Five years later the boy came under their observation and stated that fifteen months

previously he had had intermittent pain in the left hip and attacks of epistaxis; three months previously, he had developed a painless swelling of the left knee which extended toward the leg and disappeared, while the skin passed through the successive stages of subcutaneous ecchymosis; finally, one month previously, a fall on his feet from a certain height resulted in acute pain in the left hip and functional incapacity: he was in bed for three weeks and then walked with a marked limp.

Physical examination revealed deficiency in bodily development, infantilism, limping, and slight shortening of the left lower extremity. Roentgen examination showed traces of fracture of the left femoral neck with displacement, osteolysis of the proximal fragment and slight osteoporosis; the lower part of the left femur had started to acquire the form of a champagne bottle and presented a slight degree of osteoporosis.

Treatment with testoviron, liver extract, and coagulants was instituted. Locally, the fracture site was stimulated by punctures, and a biopsy was made. Histological examination revealed the presence of pathological elements similar to the splenic cells previously found in this patient, on the basis of which the diagnosis of Gaucher's disease had been made.

In these cases it is better to speak of an osseous form of the disease than of a complication, as the skeletal localization is clinically rather frequent and the bone marrow is always involved. The diagnosis is not difficult because the bone symptoms do not appear by themselves but are part of the general picture in which the splenomegaly, anemia, and tendency to hemorrhages are evident. When there are manifestations in the epiphysis, the integrity of the articular interline and the absence of osseous and periosteal reaction must be taken into consideration. Concomitant localizations in other bones suggest a disease of the osseous system. Biopsy of the bone marrow establishes the diagnosis. The relationship of Gaucher's disease to that of Niemann-Pick and of Hand-Schueller-Christian is well known: there is an alteration of the lipoid metabolism in the three disorders, but each has its own characteristics.

It has been claimed that splenectomy aggravates bone lesions and favors the appearance of new foci. This is hard to prove. It seems rather that splenectomy has no effect on the pathological process of the skeleton; on the other hand, it certainly has a beneficial influence on the general disease in selected cases. However, the mortality of splenectomized patients with Gaucher's disease still reaches from 15 to 20 per cent. Roentgen therapy is useless and may be dangerous, according to some authors.

RICHARD KEMEL, M.D.

Zadek, I.: Stenosing Tenovaginitis of the Thumb in Infants. *J. Bone & Joint Surg.*, 1942, 24: 326.

Two cases of stenosing tenovaginitis in infants are described; both cases presented a fixed deformity and not a snapping thumb. The terminal phalanx was flexed to about 140 degrees and a thickening could be felt at the first metacarpophalangeal articulation; this is often mistaken for a sesamoid bone. Also, because of the fixed deformity, a diagnosis of dislocation is frequently made. On attempted complete extension of the thumb, blanching of the skin and tautening of the flexor tendon appeared. Complete flexion of the thumb was unopposed. In adults one finds a snapping of the thumb on flexion or extension as the thickened portion of the tendon passes through the narrowed sheath, but in children this phenomenon has never been observed.

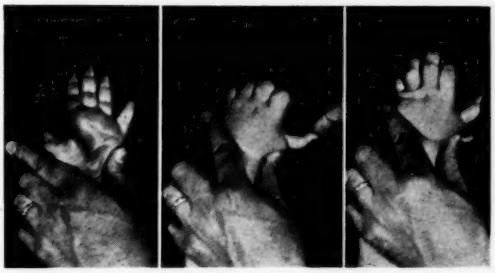

Fig. 1. Showing the fixed flexion deformity of the thumb.

One infant, aged twenty-three months, presented the described symptoms after a diagnosis of dislocation of the left thumb had been made. At operation the sheath was split and the tendon released. Six months later a similar deformity was noted in the opposite thumb which was also treated surgically. Complete recovery followed.

Another infant of nineteen months presented the fixed deformity with flexion of 145 degrees and swelling over the flexor surface of the neck of the first metacarpal. Complete recovery followed surgical release of the tendon.

Splitting of the affected tendon sheath is sufficient to effect a cure. The tendon is found thickened proximal to the constriction. The subcutaneous tissue and skin are closed, the sheath being left open.

DANIEL H. LEVINTHAL, M.D.

Murray, C. R.: Complicating Factors in the Treatment of Injuries to the Menisci of the Knee. *Am. J. Surg.*, 1942, 55: 262.

The author describes his experience in operating on 461 knee cases as well as the follow-up care from two to five years. All injuries seen for the first time were treated conservatively unless unlocking was not possible. When the joint could not be unlocked, a cast from the ankle to the groin was applied after aspiration of the hemarthrosis. In the knees seen at operation there were, besides the obvious meniscus tears, hypertrophied fat pads, loose bodies, fraying of the articular cartilage, unsuspected cruciate tears, synovial changes, and anterior or posterior loose attachments.

Seventy per cent of the cases had more than one lesion. The author therefore insists on adequate ex-

posure and deplores the use of the small incision. Another departure from the accepted procedure is discard of the tourniquet with avoidance of anoxemia of the tissues. By elevation of the foot of the table the bleeding is lessened and by flexion of the knee before the synovia is opened, a minimum of bleeding is encountered. Hemostasis is secured with the clamp and cautery. After removal of the diseased portion, the joint is irrigated with saline solution and the synovia is left unsutured. This permits the secretion to escape into the surrounding tissues. A pressure bandage is also applied.

Muscle rehabilitation is begun early, i.e., within forty-eight hours of the operation. The patients are taught quadriceps exercises before going to surgery, and if it is difficult to initiate these exercises postoperatively, an induction coil is used. Quadriceps weakness must be prevented through voluntary exercise and use! Knee bending is begun as soon as the pressure bandage is released; on the fifth or sixth day the patient walks with crutches, and he usually leaves the hospital without support on the ninth day.

DANIEL H. LEVINTHAL, M.D.

Key, J. A., and Large, A. M.: Histoplasmosis of the Knee. *J. Bone & Joint Surg.*, 1942, 24: 281.

Histoplasmosis or reticuloendothelial cytomycosis is a generalized disease which varies widely in its clinical characteristics and is caused by the histoplasma capsulatum of Darling. This organism was discovered by Darling in 1906 while he was searching for evidence of kala-azar in smears from the spleen, liver, and bone marrow of all patients showing splenomegaly and who came to autopsy at the Ancon Hospital. Darling noted the similarity of the organism to the Leishman-Donovan body of kala-azar, but pointed out that it differed from this in the form and arrangement of the chromatin of the nucleus, and in that it did not possess a blepharoplast.

Meleney, in a review of the subject, notes that no further cases were recorded until 1925 when a case was discovered in Minnesota. In his article he reviews the 19 cases in the literature, and adds 13 new cases. He states that while the disease is rarely diagnosed, it is probable that it is considerably more frequent than is supposed, that it is widely distributed throughout the world, and that it will undoubtedly be recognized with increasing frequency in the future. He finds that the disease known as histoplasmosis may present one of the four following clinical pictures:

1. A systemic febrile disease similar to kala-azar, with an enlarged liver and spleen, septic temperature, anemia, and leucopenia.

2. Lymph-node enlargement may predominate, and for this reason the condition may simulate Hodgkin's disease, leucemia, lymphosarcoma, or aplastic anemia.

3. Pulmonary symptoms may predominate. The infection is often complicated by, or superimposed upon, pulmonary or generalized tuberculosis.

4. The infection may begin as a small skin lesion which may sometimes develop into a generalized ulcerative skin condition.

The organism as found in the tissues is round or oval in shape and measures from 1 to 4 micra in diameter. It has a deeply staining, basophilic central mass, or chromatin nucleus, which may be round, ovoid, or semilunar in shape. This is surrounded by a clear space, which in turn is surrounded by a refractile achromatic rim. This is the yeastlike form of the fungus.

In so far as the authors have been able to determine, none of the cases in the literature presented any involvement of the joints or muscles. Recently one of the authors has had under his care a patient from whom the sections from the specimen of the knee joint showed the typical histoplasma capsulatum of Darling. The case is being reported because it is believed to be the first instance in which the disease has been known to involve a joint, and was so diagnosed until it was found that the guinea-pig inoculation and the tuberculin test on the patient were negative. It was then thought to be a low-grade infection of unknown origin. The limb was amputated and the correct diagnosis was arrived at only when it was made by the department of pathology.

Even had an early diagnosis been arrived at in the authors' case, it is probable that the fatal outcome of the disease could not have been avoided, because, with 2 exceptions, in all of the cases recorded in the literature the patients have died of the disease. Meleney believes that antimony preparations may offer hope of cure. His article should be consulted by those wishing to learn more of the disease. It is to be noted that in the authors' patient the administration of full doses of sulfathiazole had no beneficial effect.

A detailed report of the case including photomicrographs and photoroentgenograms is presented.

ROBERT P. MONTGOMERY, M.D.

Kulowski, J.: Post-Traumatic Para-Articular Ossification of the Knee Joint (Pellegrini-Stieda Disease). *Am. J. Roentgenol.*, 1942, 47: 392.

Pellegrini-Stieda disease is characterized by a post-traumatic, well defined calcification and/or ossification in the region of the medial femoral condyle. The literature relating to it is reviewed and cases reported in the English language are tabulated as to age, sex, history of trauma, duration of symptoms, presence of associated conditions, treatment, and comment. Case histories of 11 additional cases studied by the author are included.

As regards incidence, percentages of 3 and 10 are cited in studies of large groups of knee injuries. The male sex is predominantly affected. The ages of the patients in reported cases ranged from twelve to seventy-one years. Trauma as the inciting factor is evident in practically all of the cases. The nature of the injury may influence the anatomical characteristics of the process. The developmental activity

and rate of growth of the calcification may be precocious or delayed. In the tabulated cases the earliest lesion was noted within three weeks of the antecedent trauma. Spontaneous resolution of the process has been observed.

Three current theories attempting to explain the development of the lesion are: (1) separation of a bony fragment; (2) periosteal ossification; and (3) calcification of the soft parts with subsequent ossification (metaplasia). These are discussed at length. Microscopic studies of surgically removed material have tended to support the hypothesis that the lesion is due usually to metaplasia of the affected ligamentous structures.

The clinical symptoms which call attention to the possibility or eventuality of the lesion are not pathognomonic but are common to most injuries of the knee joint. Pain continuing beyond the period of recovery to be expected from the nature of the injury or becoming intensified should suggest the possibility and indicate a roentgen examination which may have to be repeated at intervals. Localized tenderness and pain with certain movements are early symptoms. Later, limitation of joint motion and fatigability incident to residual muscle atrophy may occur, and infiltration, thickening, or a calcified mass may be palpable.

The final diagnosis rests entirely on the roentgenographic findings. According to the stage of development, two main types are recognized, the evolutive and the stabilized forms. The former appears as an active, more or less hazy or fuzzy variegated opacification of the adjacent connective tissue. The latter reveals a mature, well defined, dense, sharply outlined calcific or ossified shadow which forms a residual covering over the medial femoral condyle. Characteristically, there is a clear radiant space of varying degree between the shadow and the femoral condyle.

Of paramount importance in prevention and prophylaxis is the rational initial treatment of ligamentous sprain. Immobilization, physical therapy, surgical extirpation, or non-interference may be indicated. Surgery is contraindicated until full maturation of the lesion has taken place. It is indicated when the ossification provokes marked disturbances. Irradiation has been used with variable success. In recent cases it may produce good results; later, only palliation can be expected from it.

From the medicolegal aspect the author believes that the incapacity from an uncomplicated lesion, properly managed from the inception of the injury, may be expected to be nil or minimal.

A. HARTUNG, M.D.

Rost, G. S.: Roentgen Manifestations of Bejel ("Endemic Syphilis") As Observed in the Euphrates River Valley. *Radiology*, 1942, 38: 320.

Bejel is a treponema endemic among the inhabitants of the Euphrates River Valley. Its relationship to syphilis and yaws has not been definitely determined. The author presents the roentgen-ray findings associated with it as another approach to its study.

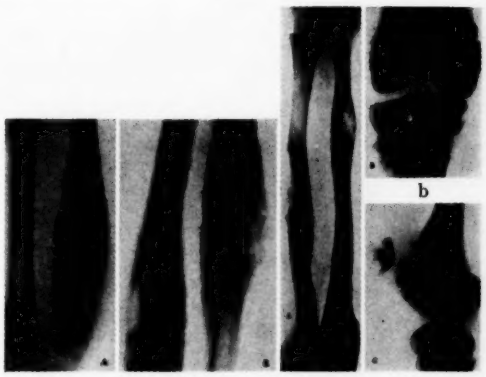

Fig. 1. left, A. Bejel in the ulna of a ten-year-old child. Slight swelling was noted for one and one-half years. Rapid increase in size during the past two months.

B. Advanced periosteal thickening as the result of bejel contracted in childhood. Symptoms for six months only. Note the moth-eaten appearance and the change in character of the periosteal proliferation.

Fig. 2. A. Roentgenogram made five months after the onset of nocturnal bone pain and deformity, and three years after initial infection. Involvement of the elbow joint and of the epiphysis of the radius, and dactylitis of the first metacarpal bone are demonstrable on the original film.

B and C. The knee joint of the same patient. Erosion of one articular surface, as well as epiphyseal and metaphyseal involvement, is present. This case demonstrates the difficulty of differentiation from tuberculosis.

These findings consist essentially of periosteal and endostal proliferation with varying degrees of rarefaction resembling the gummas of late syphilis. Roentgen-ray evidence similar to that seen in early

Fig. 3. A. Localized lesion in a boy fourteen years of age. The soft palate had been destroyed by a typical ulcer of late bejel.

B. Untreated localized involvement in another boy fourteen years of age.

C. Same case as in B, one month after induction of treatment. The patient received 0.75 gm. of metal during the interval.

D. The tibia as seen in bejel of twelve years' standing. The patient was thirty-five years old and had had no treatment. There was no complaint referable to this region. Note the variation in contour and density.

heredosyphilis is lacking. The absence of neuropathic joint lesions is noted and roentgen manifestations of associated cardiovascular involvement have also been absent. In view of the differences and similarities found it is suggested that final classification of the disease in its relationship to syphilis and yaws be reserved, pending the narrowing of the present hiatus in our knowledge of these disease entities. A. HARTUNG, M.D.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Irwin, C. E.: Transplants to the Thumb to Restore the Function of Opposition; End-Results. *South. M. J.*, 1942, 35: 257.

To restore the function of opposition transplantation of the flexor sublimis tendon of the ring finger is the procedure of choice and may be reinforced when necessary by the use of other available flexor muscles. Sixteen of 19 patients on which this operation was performed showed good or fair power.

When the function of opposition of the thumb is lost, the thenar eminence is atrophied and the thumb metacarpal can be easily outlined. The palm is wider because of extension and external rotation of the metacarpal of the thumb and the grasping ability of the hand is decreased. The finer and more skillful movements of the normal hand are lost. The three extrinsic muscles that take part in thumb opposition are: the flexor, the extensor, and the abductor pollicis longus muscles. It is essential that ample functional strength is present in these three muscles before a transplant can be contemplated.

It is necessary to make the pull of the transplanted tendon on the thumb in the direction of the pisiform bone to provide the desired adduction. The point of attachment of the transplanted tendon is made to the thumb so as to provide the necessary rotation. The flexor sublimis of the fourth finger is universally used primarily.

In order to insure a good end-result it is necessary that (1) the course of the transplanted tendons from the muscle belly to the pulley be in a straight line; (2) the pulley must be so constructed that its original position be in a straight line; (3) the pulley must be so constructed that it will allow free gliding movement of the tendon; (4) the tendon must lie in front of or toward the flexor side of the metacarpophalangeal joint as it passes to its insertion in the base of the proximal phalanx; (5) the tendon is fastened directly in the bone and enters the proximal phalanx of the thumb on the border adjacent to the web. Other flexor muscles are not incorporated with the basic transplant unless it has been necessary to arthrodese the radiocarpal joint. Secondary tendons must be attached to the tendon of the basic transplant proximal to the pulley.

The operation is performed under a general anesthetic. A blood pressure cuff is used for a tourniquet. Three small incisions are necessary: the first is made transversely in a flexor crease at the base of the fourth finger; the second incision is made in the flexor crease at the wrist; and the third incision is made parallel to the long axis of the shaft of the proximal phalanx of the thumb. The tendon is passed through a subcutaneous tunnel made through the thenar eminence. The distal end of the tendon is slit and a portion of the correct diameter is passed through the drill hole. The hand is immobilized from the axilla to the tip of the fingers, the elbow is flexed, with the forearm in supination, thumb in opposing position and the fingers straight.

The contraindications to this type of operation are enumerated. Postoperative care keeps the thumb in the proper position by means of a splint which was made and fitted before operation. At the end of two weeks the splint is removed for physical therapy and the patient is taught to use the transplant voluntarily. The thumb is splinted for a total of six weeks at the end of which time the apparatus is removed, entirely. RICHARD J. BENNETT, JR., M.D.

Howorth, M. B.: Leg-Shortening Operation for Equalizing Leg Length. *Arch. Surg.*, 1942, 44:543.

Seventeen leg-shortening operations are reported, including 11 step-cut osteotomies with Lane plate fixation. The technique of the operation and the postoperative care are as follows:

The midfemur is exposed by an anterolateral incision through the vastus lateralis and vastus intermedius muscles. Osteotomy is done with drill holes and the osteotome, or with a circular or reciprocating saw. It is important when a motor saw is used to avoid burning of the bone or leaving it glassy smooth. The step-cut may be made before or after the femur is divided and the fragments fitted accurately together. The plate is shaped to fit the fragments closely without force. The fragments and the plate are held apposed with Lambotte, Heitz-Boyer, or Jackson clamps while holes are drilled perpendicularly through the plate holes and both cortices of the femur. The drill is of the exact diameter of the shaft of the screw, exclusive of threads. Self-tapping untapered screws are used, threaded from end to end. They are driven carefully, to avoid stripping the bone threads as the tapping is done, and yet snugly. The screw should be just long enough to penetrate the opposite cortex when it is set. It is preferable to have two, or more, of the screws traverse both tongues of the step-cut, and the screws should pass at least ¼ in. (0.6 cm.) from the cut ends. The fragments should be firmly held on completion of the plating. It is planned to use the stainless steel plates.

A double spica from the midthorax to the toes of the affected side was used in most cases, but a single spica may be used for a thin person, particularly if the hip is fused. The spica is removed for roentgen examination at the end of three months and is usually left off; the patient is allowed a week or two in bed for the return of muscle power and joint motion; then walking without weight bearing is begun with a walker or crutches. Massage, heat, and under-

water and other exercises are used for several weeks after the plaster is removed.

Sixteen patients, with 17 femoral shortenings have been followed up for from one to eleven years, an average of four and a half years. There were no infections of wounds, no deaths, and no nonunions. The 1 case in which a poorly applied plate held the fragments apart until the plate broke may be considered an instance of delayed union. Two of the early unplated femurs were found to have an overriding of ¼ in.

Angulation of from 5 to 15 degrees occurred in 7 cases, but plates were used in only 2 of these. Hip and knee motion and muscle power returned to normal within six months after the operation in every case. The residual leg inequality varied from nothing to 2 in. and averaged ½ in. In 1 case, in which there was a total shortening of 7½ in., the opposite tibia and fibula were lengthened 2½ in., while the femur was shortened 3 in. The limp was greatly reduced or eliminated in all cases but 1; the patient in this case was a girl with extensive poliomyelitis who felt that she had not benefited by the operation. Built-up shoes were discarded in all but 2 cases, and in these the lift was reduced. The appearance of all patients was improved, and none complained of shortened stature. Capacity for walking and more strenuous activities was usually improved; several of the patients were able to participate in all sports. Thus, 11 cases of successful leg-shortening with step-cut osteotomy and Lane plate are added to the 10 cases of simple osteotomy, or resection, with the use of some type of plate reported in the literature. The same technique, possibly with transverse instead of step-cut osteotomy, should be equally applicable to the tibia. However, in most cases all or most of the shortening occurs in the femur, and since it is desirable to have the knees opposite each other for appearance as well as mechanical efficiency, it is preferable to shorten the bone which is relatively longer.

The leg-shortening operation usually shortens the height of the patient less than the length of the bone removed. If the patient stands with the legs straight without a lift, the shortening of the body is only half the shortening of the leg as the pelvic tilt is corrected and the opposite leg remains the same. If the patient must stand on the short leg with the knee and hip of the long leg flexed, the body height is not less after the shortening, as the longer leg is then merely straightened. If the subject wears a raised shoe and changes to a regular shoe after the operation, the height is reduced by the amount of the lift. A short person can partially make up for the shortening by wearing higher heels. Removal of several inches from the leg may cause a noticeable shortening of the legs in relation to the trunk. Since most people sit most of their waking hours and leg-shortening does not affect the sitting height, there is little disadvantage to most persons in losing from 1 to 3 in. of standing height. The physical advantage of lowering the center of gravity, noted by White, especially when the leg is weak, the improvement in walking and other physical activities, as well as the removal of a built-up shoe, more than offset the loss of height.

A B

Fig. 1. A girl thirteen years of age had tuberculosis of the left knee, which had previously been resected. The leg was 7½ in. (19 cm.) short. The left tibia was lengthened 2⅝ in. (6.7 cm.). One inch (2.5 cm.) resection of the right femur was done, and there was an overlapping of 2½ in. (6.4 cm.). Excellent alignment of the plate and the fragments was obtained, and solid union occurred in three months. A, Three months after operation; B, six months after operation.

The operation is not a simple one and must be done with precision and minimal risk of infection or nonunion, but it is a far simpler and safer procedure than leg-lengthening. The step-cut osteotomy with bone plating offers an accurate method of shortening the femur and maintaining good alignment. Solid bony union occurs in a reasonable time, and there is a minimum of interference with muscle and joint action. The operation is rarely applicable to children under twelve years of age, because of the difficulty in predicting the exact difference in adult leg length and total height, and the greater simplicity of epiphyseal exeresis. This technique should be suitable for certain types of war injuries to the bones of the leg. Before the operation is undertaken, all the important factors such as age, sex, occupation, total body height, leg-length discrepancy, associated deformity, weakness, ankylosis, and physical performance should be evaluated.

The causes and prevention of leg inequality are discussed, and various other methods of correction are briefly described and evaluated. The history of the leg-shortening operation is given, including the different methods of shortening the bone and of fixing the fragments. The leg has been shortened by osteotomy with overriding, resection, or step-cutting, and the fragments have been fixed by various types of intramedullary or transverse pegs, onlay or inlay grafts, mortise and tenon, or tenon

with intramedullary impaction, wire sutures, or metal plates.

The step-cut osteotomy with Lane-plate fixation is recommended as an effective and precise method of shortening the leg and securing prompt and strong union of the fragments.

ROBERT P. MONTGOMERY. M. D.

FRACTURES AND DISLOCATIONS

Martin, R. C.: Atlas-Axis Dislocation Following Cervical Infection. *J. Am. M. Ass.*, 1942, 118: 874.

Dislocation of the axis on the atlas may be traumatic (with fracture of the odontoid and resultant spinal-cord trauma), or it may be secondary to a cervical infection. An understanding of the mechanics of this dislocation requires a knowledge of the anatomy of the articulations and ligaments. There are two lateral articulations which are arthrodial diarthroses; the third is a rotary diarthrosis between the odontoid and the articular facet on the posterior aspect of the anterior arch of the atlas. Each joint has an articular capsule, in addition to the strong anterior atloaxoid, posterior atloaxoid, and transverse ligament of the atlas which attaches laterally to the tubercles on the median aspect, running posterior to the neck of the odontoid process to hold it in place.

The author's explanation of the pathological changes occurring is that of Grieg: cervical infections produce hyperemia, and this results in vertebral decalcification and loosening of the ligamentous attachments. One or both of the lateral articular facets of the atlas slip forward and lock as the facet slips forward and downward over the opposing facet of the axis. Or, one or both of the articular facets of the atlas may slip backward. If both slip backward to any degree death may supervene since this displacement cannot occur without forcing the odontoid posteriorly and thus crushing the spinal cord. Berkheiser and Seidler presented 2 such cases in a series of 5.

Clinically, there is torticollis and tenderness over the lateral masses of the atlas and axis.

It is emphasized that care must be exercised in handling a patient for operation and moving him postoperatively after severe or chronic cervical infections.

Several cases following tonsillectomy have been reported. The differential diagnosis from retropharyngeal abscess must be made on a basis of careful local examination and in addition, roentgen-ray examination.

The author's treatment is based on gentle manipulation—first by accentuating the deformity with traction and thus unlocking the lips of the lateral articular facets. This is followed by extension and bringing the head to the midline while rotating the chin to its normal position. Plaster fixation is then used until healing takes place.

A series of 4 cases with reduction as described is reported. LEO MARKIN, M.D.

Slullitel, I.: Gangrene in Closed Fractures of the Extremities (Gangrena en las fracturas cerradas de miembros). *Rev. de ortop. y traumatol.*, 1942, 11: 245.

The author reports a case of an oblique fracture of the tibia and one of a crushed fracture of the head of the fibula, seen many days after the injury was received, exhibiting manifestations of frank arterial ischemia below the site of the fracture. The first patient received a fracture of the tibia without displacement followed by intense edema of the leg, blisters, ecchymosis, and obliteration of both tibial arteries. In the second case the site of injury was the popliteal groove where there were many blisters, small ulcerations, and intense edema. The toes and the foot up to the instep were black, anesthetic, and cold; there were no pulsations. The author believes that this was a case of arterial contusion with injury of the intima and perhaps of the media with resultant thrombosis and obliteration of the vessels. In each case the leg was amputated.

There have been few reported cases of this condition. In 1935, Dodd reported that 31 cases had been published from 1850 to 1914, and he had collected 10 cases published since then. These injuries occur most often in the lower extremity probably because the vessels in this region are much more vulnerable. Although some have attributed this complication to the use of bandages, tight plasters, or skeletal traction, none of these were used in the cases reported. The author believes the contributing factor to be pre-existing arterial damage.

Most reported cases have been treated by amputation. Of 24 cases collected by Dodd all but 4 were treated by amputation; the mortality was 54 per cent. Arteriography is undesirable because it is not a simple procedure and is harmful to the patients, also because it is often difficult to localize the lesion or to determine its length. Sympathectomy has been tried by Watson-Jones and Muir but was unsuccessful. MICHAEL DEBAKEY, M.D.

Naylor, A.: Monteggia Fractures. *Brit. J. Surg.*, 1942, 29: 323.

Despite their comparative rarity, Monteggia's lesions are important because of the frequency with which the radial dislocation is overlooked, and the economic loss resulting from this. The common type of Monteggia fracture involves the upper third of the ulna, 3 or 4 in. below the tip of the olecranon process, and is associated with anterior dislocation of the head of the radius. This type of lesion occurred in 6 of the 9 cases studied. Occasionally, the head of the radius is dislocated laterally. This occurred in 2 of the 9 cases reviewed.

The lesion occurs most frequently in children aged from five to seven years, and is due to a blow or a fall on the elbow or upper forearm.

The head of the radius may be palpated anterior to the lower end of the humerus, while a depression can often be noted behind and below the external condyle in early cases, before swelling obscures the

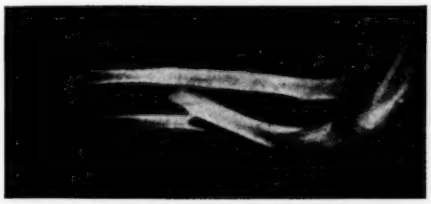

Fig. 1. Roentgenograph of typical Monteggia fracture.

bony landmarks. Pronation and supination are usually impossible because of pain.

Roentgenographs revealing displacement of a fragment in a fracture of the upper third of the ulna should always focus attention upon the head of the radius, because such a lesion must be associated with disturbance of the superior radioulnar joint.

In the author's series of cases, one-third of the fractures were compound, a complication which one would expect with lesions following direct violence.

An equally common complication is fracture of the dislocated radial head. This is usually of the marginal type, with displacement. Radial nerve palsy occurred in one case. Nonunion of the ulnar fracture is very liable to occur in a Monteggia fracture, although this did not complicate any of the author's cases.

Manual traction, or traction by means of fingerstall grips in a traction apparatus, and application of a plaster cast with the elbow-joint fixed at right angles and pronated, was attempted in all cases, and was successful in the majority of uncomplicated cases. Although reduction is usually obtained in this manner, maintenance of the reduction may be impossible. In 2 cases the reduction was obtained and maintained by fixing the elbow in flexion and supination, and this method is usually successful with all cases except when there is posterior dislocation of the radius.

Unfortunately, angulation of the ulnar fragments is prone to result in this position, and open fixation of the ulna may be necessary. Repeated attempts at closed reduction should not be made, as this is very liable to result in marked restriction of movement later. In this series manipulative methods failed on only 2 occasions.

If manipulation fails, open reduction of the radial dislocation should be attempted, followed by fixation of the elbow in a plaster cast in midpronation and at right angles, after traction in this position. This is usually sufficient to allow reduction of any ulnar displacement, but open fixation of the fragments will have to be performed if displacement still persists.

Early open reduction for uncomplicated cases is advocated by some workers, but this method should be discouraged. In the author's experience closed reduction can be obtained in the majority of cases by means of Boehler's method, and, failing this, by fixation in flexion and supination.

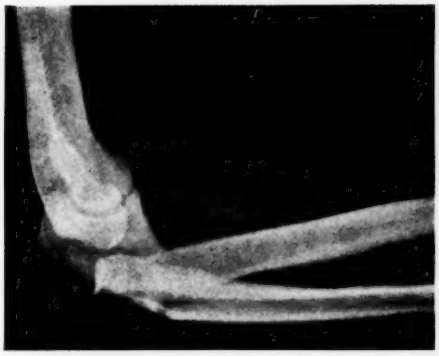

Fig. 2. Roentgenograph showing the fracture of the ulna, and head of the radius, with posterior dislocation of the radial head.

There is a tendency to stress operative repair of the orbicular ligament in recent cases. This is unnecessary when accurate reduction of the radial head is obtained. In not 1 case of this series was any attempt made to repair the orbicular ligament, and the functional results obtained fully justify this statement.

Posterior dislocations require fixation of the elbow in full extension and supination.

When fracture of the radial head complicates the injury, open reduction associated with excision of the radial fragments should be an immediate measure, followed by the reduction of the ulnar fracture by means of traction with the elbow in midposition. Excision of the radial head in uncomplicated recent cases is to be condemned, especially in children, in which growth will be interfered with, followed by cubitus valgus and late ulnar neuritis. In children, reduction of the radial dislocation is all important, and slight ulnar deviation can be ignored if this reduction is perfect. The method of fixation in flexion and supination is, therefore, excellent for these cases.

Old unreduced cases are characterized by pain, instability, and restricted movement, especially pronation and supination. They are not common. Flexion is usually limited by the bony block arising from the malunited ulna or the dislocated head of the radius. Excision of the head of the radius in such cases in adults will often effect an improvement in function and the reduction of pain. In some cases angulation of the ulna may be corrected by osteotomy, and dislocation of the radial head then reduced. This reduction must be maintained by construction of a new orbicular ligament from the bicipital fascia, by use of a free transplant from the palmaris longus, or by repair and fixation according to Speed and Boyd, which are especially suitable for these cases. As nonunion of the ulna is usually due to the prevention of firm apposition of the ulnar fragments by the radius, a first measure in treating this complication in older subjects should be exci-

sion of the head of the radius. The ulnar fragments can then be fixed in good alignment and apposition, preferably by means of a bone graft.

In old cases of nonreduction in children, the chief disability is the visible deformity. Function is usually good, and any operative interference to improve the appearance in such cases is to be condemned. Excision of the dislocated radial head is apt to be followed by increased cubitus valgus. Any defective function should be treated by intensive physical therapy. Operative treatment is to be avoided as much as possible. When function is very poor, and in girls for whom appearance is of importance, Speed and Boyd's method of fixation and repair is likely to effect an improvement.

A search through the available literature leaves one with the impression that full function following a Monteggia fracture is a rarity. Although one should not be too optimistic when reviewing a small series of cases, the results in those described tend to dispel this idea. The average disability period for the whole of the series was fifteen weeks, but only eight weeks for the cases occurring in children. The cases show that extension and supination are the movements which are recovered with difficulty, and that late reduction is a factor producing restricted movement. In 4 cases complete function was restored, and in 1 case all movements were restored but there was a slight limitation of pronation. In 3 cases extension was limited to from 130 to 160 degrees. American workers stress the importance of ulnar alignment in determining the amount of rotation obtained. Yet, in the author's cases, in which rotation was impaired, ulnar alignment was very good. The least satisfactory result was obtained when open reduction and plating followed repeated failures to obtain closed reduction.

One is impressed by the good results obtained in children, and when closed reduction is obtained early. Better results of the treatment of Monteggia fractures are to be obtained by early recognition of the radial dislocation and its reduction by closed methods with a minimum of periarticular trauma, than by devising operative procedures to produce accurate anatomical alignment of the ulna and repair of the orbicular ligament.

ROBERT P. MONTGOMERY, M.D.

Greening, W. P.: Isolated Fracture of the Carpal Cuneiform Bone. *Brit. M. J.*, 1942, 1: 221.

A total of 20 cases of fracture of the carpal cuneiform bone are presented, of which 17 cases were isolated fractures of the cuneiform bone and 3 cases were associated with fracture of the lower end of the radius. These 20 cases were among 580 cases of injury to the wrist which were seen during the past two years.

This type of fracture was the result of a fall on the outstretched hand, and of the total of 20 cases seen, none was due to direct injury.

There is considerable swelling and a localized point of tenderness over the cuneiform bone on the ulnar aspect of the dorsum of the wrist. The x-rays did not reveal a fracture as seen in the anteroposterior view, but in the lateral view the fracture could be recognized. The author divides this fracture into three separate types. He states that the fracture is due to the fact that the carpal cuneiform bone is compressed between the pisiform and the lower end of the ulna, the hand being in the dorsiflexed position at the time.

Treatment consisted in immobilization in plaster-of-Paris for three weeks, following which there has been no recurrence of symptoms.

RICHARD J. BENNETT, JR., M.D.

Darley, W., Gordon, R. W., and Matchett, F.: Spontaneous Vertebral Compression Fractures Due to Senile Osteoporosis. *Rocky Mountain M. J.*, 1942, 39: 193.

As a predisposing cause of vertebral compression fracture, senile osteoporosis is superseded only by metastases of breast carcinoma. Recent interest in the subject has been stimulated by the work of Albright and his associates. These men point out that two continuous processes (formation and resorption) account for the structure of adult bone. Osteoporosis constitutes a failure of the osteoblasts to form bone matrix rather than a disorder of the calcium metabolism. Osteoporosis is frequently associated with periods of inactivity—consequently the sedentary lives of older people may be considered a factor in the condition.

Endocrine factors, as shown by cases of postmenopausal osteoporosis, may play an important role. So far, cases under treatment for more than two years have shown no roentgen evidence of increased bone density.

There is no evidence to support the view that increased availability of calcium and phosphorus stimulates osteoporosis activity.

Osteoporosis is a condition largely limited to the female. The usual age of onset is between forty-five and seventy years. The spine and pelvis, never the skull, are chiefly involved. Symptoms are not due to the condition *per se* but to the common complication, that is, compression fracture of the vertebral bodies and ballooning of the intervertebral disks. The lower thoracic and upper lumbar regions are those most frequently involved; involvement is usually multiple. A history of precipitating strain or trauma, often mild, may or may not be present.

Characteristic symptoms are lumbar or lower thoracic pain, or headache, slow or sudden in onset, mild or severe in character, and with or without radiation. There may be a prodromal period of backache, of months or years before the onset of typical symptoms, viz: local tenderness over the involved bone and muscle spasm with limited motion.

Thoracic kyphosis and cervical lordosis are usually marked and on walking or standing an attitude of marked lumbar lordosis is assumed. Gradual loss of stature is common. The roentgen rays are the most important diagnostic aid. Other types of compres-

sion fracture, metastatic malignancy, multiple myeloma, and hypertrophic arthritis should be ruled out. Blood-chemistry studies are of value in the differential diagnosis.

A summary of the authors' 9 cases is presented. The treatment is emphasized from the standpoint of prophylaxis. Since inactivity is a factor in the etiology of osteoporosis, a rigid rest regime is to be avoided. Adequate protein and calcium intake are to be urged. Estrogenic substances are given and urine tests for calcium are done to determine the adequacy of the estrin therapy.

Standard orthopedic care for the spine fracture is recommended, with adequate retentive apparatus. Deep roentgen therapy in 1 case appeared to relieve severe root pain. Usually mild analgesics suffice to control the pain. LEO MARKIN, M.D.

ORTHOPEDICS IN GENERAL

Kahlstrom, S. C.: Bone Infarcts. *Am. J. Roentgenol.*, 1942, 47: 405.

Five cases of multiple infarcts of bone are reported. One patient was a caisson worker; 3 patients had never been exposed to compressed air, but presented evidence of arteriosclerosis; the fifth patient showed no evidence of arteriosclerosis and gave no history of caisson disease.

The roentgenological features of infarcts of the diaphysis are characteristic, with well defined, often symmetrical mottled areas of increased density involving the medullary portions of the diaphysis. Sometimes the mottled areas extend into the epiphysis. Involvement of the nonarticular cortex is infrequent. The size of the lesion varies from mere flecks to several decimeters. The larger lesions are often separated from the normal bone by a narrow zone of calcification and frequently contain cystic areas with surrounding calcification. The necrotic bone may become completely calcified, leaving a homogenous, dense, nonreticulated defect.

Fig. 1. The right knee shows well defined mottled calcific deposits in the metaphyses of the tibia and femur.

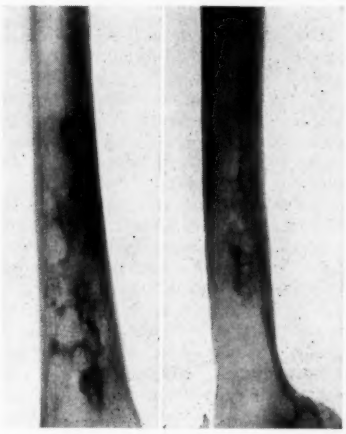

Fig. 2. Somewhat more extensive involvement of the right femur.

Phemister made a histological study of an infarct in the tibia from a patient who died of arteriosclerosis and cardiac decompensation. There was no history of caisson disease in this patient. Chandler also demonstrated infarcts in the femoral heads following an obliterative process of the supplying artery when caisson disease was not a factor.

The clinical diagnosis is usually made by roentgen examination. The history may be one of pain and limitation of motion; however, in 1 of the reported cases there was no history of pain. On examination there may be limitation of motion, pain, and considerable crepitus in the involved area.

HENRY L. JAFFE, M.D.

Morton, J. J.: Interinnominoabdominal (Hindquarter) Amputation. *Ann. Surg.*, 1942, 115: 628.

The author reports 4 cases of interinnominoabdominal or so-called "hindquarter" amputation. The first 2 patients of this series had advanced malignancies. They were afforded palliation and comfort—one for thirteen months and the other for twenty months. The third patient had a tumor of the innominate bone, which was diagnosed after removal as a metastatic carcinoma from the thyroid gland. Roentgen-ray treatment was given to the thyroid, and the patient was gaining weight and apparently well seventeen months after the operation. The fourth operation was done for a chronic osteomyelitis of the innominate bone and the patient was much improved fifteen months after the operation.

In 3 cases the anesthetic used was nitrous oxide-oxygen for induction followed by ether. Avertion was employed as a basal anesthetic in 2 of these cases. The fourth case received vinethene followed by ether. The authors first place the patient upon his back. The anterior part of the incision is then made from the symphysis along the iliac crest to the posterior superior spine. The anterior dissection is accomplished extraperitoneally. The external iliac artery and vein are transfixed by sutures and divided. The division of Poupart's ligament makes access easy. The rectus abdominis is freed and the symphysis divided. The patient is then turned on the sound side and the incision carried posteriorly down to the gluteal fold and across the trochanteric region to the inner side of the thigh. The perineal incision joins the inner end of the anterior incision over the symphysis. The iliac bone is divided from the crest to the sacrosciatic notch. The gluteus maximus should be saved if possible. The iliopsaos muscle is divided, as well as the pyriformis and levator ani. After division of the sciatic nerve the limb is freed. The gluteus maximus makes a very satisfactory covering. However, if tumor tissue has invaded the gluteus muscle, flaps must be otherwise developed. Skin grafts may be necessary. Tidal irrigation of the bladder is used postoperatively. The patient must use crutches and no apparatus can be fitted.

The authors believe that this operation should be used oftener, and that the results of the operation will be improved when the surgeons realize that the operation can be undertaken with relative safety.

HAWTHORNE C. WALLACE, M.D.

Bancroft, F. W., Fuller, A. G., and Ruggiero, W. F.: Improved Methods in Extremity Amputations for Diabetic Gangrene. *Ann. Surg.*, 1942, 115: 621.

The authors report two modifications of technique which in their hands have reduced the mortality in midthigh amputations for either arteriosclerotic or diabetic gangrene. They assert that these two procedures have reduced the mortality in 13 amputations to about 25 per cent of that previously prevailing.

These procedures are, first, technique of amputation and, second, the use of refrigeration of the limb as an anesthetic. A circular incision is made at the level of the insertion of the patellar tendon. Skin and fascia are incised in the primary incision. As they are incised they are held together by skin clips in order to prevent separation of the subcutaneous fat from the fascia. The patellar tendon is cut, then the biceps tendon near its insertion. Tape is passed around the vessels and tied securely, and the vessels are clamped distal to the tape. Then the vessels and nerves are cut. The lateral hamstring tendons are then transected. All structures are then sleeved out closely following the margins of the femur. This coming-out process is carried out until all attachments of the femur are freed to the desired level. Then the femur is cut with the Gigli saw. The vessels which had been grasped with tape earlier are isolated, ligated, and cut. The sciatic nerve is dissected upward, injected with alcohol and ligated. The clips which join the fascia to the skin are removed, the fascia is sutured and the wound loosely closed.

The authors have been using refrigeration as an anesthetic. A tourniquet is applied over an area which has previously been kept cold for about ten minutes with cracked ice. After application of the tourniquet the entire leg is packed in finely cracked ice. The ice or ice water must extend about two inches above the tourniquet. Immersion for about two hours is sufficient. The patient is brought to the operating room with the leg in ice, usually without any morphine. His ordinary eating routine need not be interrupted. The amputation is then done immediately after the ice is removed. Postoperatively the stump is gradually defrigerated with the use of ice bags. The skin temperature during the refrigeration is between 5° and 19°C.

The authors state that because of the fact that this work was done at Welfare Island, the patients treated were older and in a poorer condition than those in the ordinary hospital as a rule. Yet nevertheless the method has been very successful.

HAWTHORNE C. WALLACE, M.D.

SURGERY OF THE BLOOD AND LYMPH SYSTEMS

BLOOD VESSELS

Harkins, H. N., and Schug, R.: The Surgical Management of Varicose Veins; Importance of Individualization in the Choice of Procedure. *Surgery*, 1942, 11: 402.

Harkins and Schug believe varicose veins should be handled only by experienced surgeons who are well acquainted with the vascular variations that may be present in these cases. The authors' report is a presentation of the principles and methods used in the treatment of 63 patients. Every detail is narrated in an exhaustive manner. The authors believe that far better results are obtained by surgery and injection combined than by injection alone. In general, they reserve injection alone for cases with (1) no palpable superficial veins above the knee, and (2) for cases with a normal Trendelenburg reaction. Their technique of injection calls for a waiting period of about ten days after the venous ligation. They have long abandoned the injection method at the time of operation, for these reasons: (a) severity of the pain might force a patient to take to his bed, with the consequent possibility of an embolism; (b) too much injection material must be used at one time; (c) it precludes the possibility of secondary incisions lower down on the thigh for fear that the injected fluid might leak out into these lower wounds.

The authors advocate the avoidance of a stereotyped operation, and insist that the surgical procedure should be individualized to fit the patient. Consequently, all venous incompetencies as determined by complete diagnostic tests should be blocked out.

They resort to high ligation and segmental excision of the saphenous vein and all its branches at the level of the fossa ovalis, and additional ligations and excisions lower down on the thigh or leg should be performed if indicated.

Better cosmetic results are obtained by stripping, rather than by excision, and stripping is preferable to excision except in cases of superficial, friable, or recently sclerosed veins, or for veins high in the thigh.

Important points in the surgical technique include the use of local anesthetics, silk, transfixation of the main vessels, elastoplast bandages, and insistence upon the ambulatory cure in all cases.

Among the 217 incisions made, only 1 ill effect of consequence was observed, a marked edema of one leg. A slight increase in edema of one leg occurred in 2 cases.

STEPHEN A. ZIEMAN, M.D.

McLaughlin, C. W., Jr.: Postoperative Gangrene of the Finger Following Digital Nerve-Block Anesthesia. Report of a Case. *Am. J. Surg.*, 1942, 55: 588.

The author reports a case in which local block anesthesia (2 per cent novocaine with adrenaline) of a finger for drainage of a paronychia was followed by the development of gangrene of the finger tip. The operation required only about five minutes and a tourniquet was in place for only a fraction of that time. Subsequently, however, the patient was instructed to use warm boric soaks in the postoperative period. This the patient did, but apparently he used excessively hot water, for severe pain developed in the finger, and when he reported again, forty-eight hours after the original operation, definite gangrene of the distal phalanx had developed. Eventually, a line of demarcation developed between the middle and distal phalanges. This required amputation, and the patient was able to return to work in five weeks. One year later, the patient again developed a paronychia which was again operated on under block anesthesia, but without adrenaline. This time he was kept in the hospital for two days so that the postoperative treatment could be carefully supervised. Convalescence was entirely uneventful on this occasion.

The contributing factors in the development of this unfortunate complication have been listed as follows: peripheral arteriosclerosis, allergic reaction to the anesthetic agent, the injection of excessive amounts of solution, vasoconstriction due to epinephrine, vascular trauma due to the tourniquet, and burns from immersing the anesthetized finger in abnormally hot solutions. The author believes that the soaking of the finger in hot boric solution was the contributing factor in his case.

He suggests that: (a) only a small amount of one-half of 1 per cent novocaine be used and that without adrenaline; (b) tourniquets be used for only a short time; (c) massage be used to encourage circulation; and (d) the finger be re-examined postoperatively within a period of two hours.

JOHN W. EPTON, M.D.

Lisa, J. R., Magiday, M., and Hart, J. F.: Peripheral Arteriosclerosis in the Diabetic and the Nondiabetic. *J. Am. M. Ass.*, 1942, 118: 1353.

The peripheral vascular pathological condition of 109 amputated legs was studied. There were 56 diabetic specimens and 53 nondiabetic specimens. The two types were in the same age period. The women outnumbered the men in the diabetic group. The opposite was true in the non-diabetic group.

The arterial changes were similar in the two groups. Acute venous occlusions and phlebosclerosis were more frequent among the nondiabetic. Infection with cellulitis was only slightly more frequent in the diabetic group. Dry gangrene occurred almost as frequently in the diabetic as in the nondiabetic. The occlusive element in arteriosclerosis is the dangerous feature in both types. The terms "dry" and "wet" gangrene do not properly describe the conditions found. More rigid criteria and more careful

differentiation between the lesions secondary to occlusive arterial disease and those due to infection should be instituted. HOWARD A. MCKNIGHT, M.D.

Hayward, G. W.: The Intravenous Administration of Serum in the Treatment of Peripheral Vascular Disease. *Brit. M. J.*, 1942, 1: 285.

One of the chief aims in the treatment of peripheral vascular disease is to aid the development of an adequate collateral circulation in the affected limbs. Good results have been obtained with passive vascular exercises by various methods. It has been shown that an adequate collateral circulation can be established after all the major arterial pathways to a limb have been obliterated. It has been claimed that procedures which increase the blood volume stimulate the formation of a collateral circulation. The beneficial results of saline or Ringer's solution given intravenously have been confirmed repeatedly. The effects of the intravenous administration of saline solution on the peripheral circulation are presumably mechanical and are produced by the immediate increase in the blood volume, but this increase is a transient one. It seemed probable that if the blood volume could be increased for a longer period of time, the effect on the peripheral circulation would be greater. For this reason the effects of increasing the blood volume by giving human serum intravenously were studied by the author. The serum used was pooled liquid serum with a protein content of 7 per cent. The amount transfused each time was 800 cc. The effects of serum transfusion on the circulation have been studied in several different ways.

In assessing the results of serum therapy, it is important to determine how long the tranfused serum remains in the circulation. Observations show that in most cases restoration of the blood volume, after the transfusion of 800 cc., takes place in from two to three days, although occasionally it may be complete in twenty-four hours. The ultimate fate of the transfused protein is still uncertain but there is evidence from animal experiments that it may be utilized in the body metabolism, or stored as unchanged protein or in the form of large aggregates of aminoacids. If the serum is administered slowly, the cardiovascular system adjusts itself to the increased blood volume readily. There is no increase of venous pressure. The extra fluid is presumably accommodated in the peripheral vascular bed by the opening up of new vascular channels. The oscillometric studies made on the patients reported herein show that in some of those with the distal type of obliterative arteritis, an increased amplitude of arterial pulsation was produced by serum transfusion, and this alone suggests increased blood flow.

The clinical results in this group of 16 patients with chronic obliterative arterial disease have been encouraging. Following the transfusion of serum the peripheral circulation in the affected limbs has improved, as shown by the disappearance of rest pain, the increased warmth of the foot, and the rapid healing of ulcers and gangrenous areas. The intravenous use of serum would, therefore, seem worthy of extended trial in patients with incipient or developed gangrene of the extremities, due to chronic arterial disease. The results in patients with intermittent claudication have been variable; some patients have been benefited considerably and others have shown no change. On the whole, the results are no better than those which have been obtained with hypertonic saline solution or intermittent venous occlusion, but when these fail, it seems that in some cases serum is successful. For simple ulcers and nonhealing wounds in normal limbs, it seems likely that the increased peripheral circulation following serum is of value. If the injected protein is stored or incorporated in the tissues, as is probable, this may be another factor in the promotion of healing.

The author states that serum has been used in this study because it has a higher protein content than the plasma which is available. Liquid plasma may be more readily obtainable because of the presence of numerous blood banks throughout the country, and although it has a lower protein content and would, therefore, not produce the same increase in blood volume, it could be used.

HERBERT F. THURSTON, M.D.

Patey, D. H.: A Case of Arteriovenous (Cirsoid) Aneurysm of the Scalp Successfully Treated by Combined Arterial Ligation and Venous Injection. *Brit. J. Surg.*, 1942, 29: 290.

Cirsoid aneurysm of the scalp has been commonly called aneurysm by anastomosis, plexiform or racemose aneurysm, and arterial angioma. Since this lesion is an arteriovenous aneurysm, the most successful means of therapy is some form of direct attack. The most common form of attack has been excision of the whole mass, but as this is often attended with severe and sometimes even fatal hemorrhage, recent reports have dealt mainly with methods of obtaining adequate hemostasis during the procedure.

In 1935, Matas suggested attacking carotid-venous-sinus aneurysm through the venous route with a sclerosing solution. In 1939, Singleton reported a case of carotid-venous-sinus aneurysm which was apparently cured by venous injection after extracranial and intracranial ligature of the carotid artery had failed. Marshall, in 1937, reported 2 cases of cirsoid aneurysms with good results following excision after preliminary arterial ligation and venous injection.

The case report presented is that of a woman who, at the age of nine years, had injured her head. This injury was followed by the appearance of a mass which persisted, with the exception of a short period following prolonged radium therapy, until 1930, when it was first seen by the authors. At that time the mass involved the entire occipital region and extended well up onto the temporal regions. It was

composed of tortuous, pulsating, dilated vessels. A systolic thrill could be palpated and a synchronous bruit heard on auscultation. In the center of the mass was a necrotic ulcer with a bleeding point in its center. Pressure over both right and left temporals and occipital arteries failed to obliterate the pulsation. Arteriographs made at operation revealed that the temporal and occipital arteries were not particularly dilated. Both the right and left external carotid arteries were ligated. This was followed by injection of the venous channels of the mass with 10 cc. of a 5 per cent solution of quinine and urethane. The postoperative course was complicated by a trismus which persisted for several weeks. Sepsis also developed in the region of the ulcer of the mass. A follow-up report at twenty months stated that the arteriovenous aneurysm has completely disappeared.

The arteriographs revealed that in this case the lesion was an arteriovenous aneurysm, not a new growth. The authors believe that proof of an angiomatous character of these tumors is not present. The etiology of these lesions can be either congenital or traumatic. In the region of the skull the trauma need not penetrate the skin.

From the view of treatment, this case illustrates that these lesions can be successfully managed by arterial ligation proximal to the lesion. This ligation is followed by injection of the tortuous veins of the lesion. The authors believe that excision of the mass is unnecessary. ALFRED B. LONGACRE, M.D.

Lagomarsino, E. H., and Dal Lago, H.: Pathological Pneumoarthroroentgenography of the Knee (Neumoartrorradiografía patológica de la rodilla). *Rev. de ortop. y traumatol.*, 1942, 11: 192.

In previous articles, the authors have presented their anatomical and experimental concepts of the identification of the normal roentgen images of the knee, of the pathological lesions of the menisci, and especially of the detachment of the anterior head of the internal meniscus in lateral exposure. They have drawn the following conclusions:

1. There is no experimental foundation for any of the signs described as expressing meniscal pathological conditions in the frontal exposure.

2. Experimentation shows that these signs are false because they are based on erroneous concepts of the roentgen interpretation of the normal image.

3. Experimentation determines the real images of simple longitudinal and looped ruptures.

4. These images have no absolute value because experimentation and clinical examination demonstrate their presence in normal cases, and their possible modification by various anatomical and roentgenological factors in pathological cases.

5. Therefore, the frontal exposure has no major clarifying value in doubtful clinical cases.

6. In lateral exposure, the signs described as belonging to lesions of the posterior heads have no value because of the difficulty in identifying the normal shadows and because of the modification of the latter by various factors within wide limits.

7. The only sign which has clinicosurgical value is that corresponding to the detachment of the anterior head of the internal meniscus.

8. Therefore, the lateral exposure is of value only to clarify the meniscal lesions in the anterior condylotibial angle, where alone the anterior head of the internal meniscus is visible.

The experimental lesions of the cruciate ligaments demonstrate that: (1) detachment and extirpation of a cruciate ligament can be easily diagnosed by roentgen examination, especially when the knee is flexed (Fick's position); (2) in recent cases without retraction of the heads, the lesion is shown by air infiltration of the detached intercondylar base; when the lesion is old with retraction of the sectioned head, a triangular area with upper right or left intercondylar base is missing in the uniform normal shadow of the two ligaments; and (3) the detachments of the tibial base are not visible because, at this level, the two ligament shadows are superimposed.

Comparison of experimental with clinical roentgenograms confirms the value of the experimental signs mentioned.

Pneumoarthroroentgenographic examination of the adipose tissue and ligament cannot give any valuable information because of the variability of their normal image and the lack of agreement between the clinical symptoms and the roentgen image. However, this applies only to nontraumatic lesions in which the pathological changes may be expressed by modifications of size and structure. However, when there is a rupture of the fatty ligament with detachment of its intercondylar insertion, the image is typical except in cases of large adipose masses which normally hide the ligament.

The method is of decisive importance in the diagnosis of what the authors call the "intercondylar syndrome" which is often present in "internal derangement of the knee joint" and consists of detachment of the anterior head of the internal meniscus, associated with rupture of the adipose ligament and more or less complete rupture of the anterior cruciate ligament. The most frequent primary symptom is hemarthrosis, and the meniscal syndrome without clinical signs on the part of the adipose and cruciate ligaments appears secondarily. The diagnosis of the triple lesion can be made only by this method. Compared with simple roentgenography, it allows more complete study of capsular and paracapsular ossifications and more exact localization of foreign bodies in the joint; it reveals more details in dissecting osteochondritis, allows the diagnosis of paracapsular serous cysts and of intra-articular tumors, and shows hypertrophic or villous synovial lesions in any exposure. RICHARD KEMEL, M.D.

LYMPH GLANDS AND LYMPHATIC VESSELS

Stout, A. P.: Is Lymphosarcoma Curable? *J. Am. M. Ass.*, 1942, 118: 968.

This study has brought out the fact that in this group of patients, although 1 survived ten years

without treatment before dying of lymphosarcoma, there were 7 who were treated for lymphosarcoma who lived that length of time and 6 of them are symptom-free. One cannot know that these 6 patients are cured but, on the other hand, it is not justifiable to assume that they are not. The great difference in favor of the treated cases over such a long period of time gives one the right to anticipate that some of these clinical cures may prove to be absolute ones.

The favorable results have been obtained almost always while the neoplasm was still relatively localized. If more cases are recognized and treated in this early stage, the number of cases of long survival will be increased. This means that earlier biopsy of enlarged nodes and suspicious tumors in the known areas of involvement must be made.

Probably because the disease usually has a focal origin, the long symptom-free survivals have followed both radiotherapy and surgery used either alone or in combination. Since lymphosarcoma is generally radiosensitive, roentgen therapy is usually preferred. If surgery is selected as the primary treatment it is probably better to follow it with roentgen therapy.

There are some factors that may be taken into consideration in the prognosis. Giant follicle tumors are the least malignant and reticulum-cell tumors the most malignant of the lymphosarcomas. If the neoplasm manifests itself before the age of twenty, the chances of long survival are minute; they are greatest if the patient has passed his fortieth year. Cases associated with leucemia are always fatal. The mouth and nasopharynx, the gastrointestinal tract, and the cervical and axillary lymph nodes are more favorable sites of origin, while the spleen, the thyroid, the mediastinum, the retroperitoneal region, and the lymph nodes are the least favorable. If the disease has involved more than two contiguous anatomical structures, the chances of symptom-free long survival are very remote. A long survival irrespective of the degree of involvement or of treatment may be expected in between 2 and 3 per cent of all the cases. JOHN J. MALONEY, M.D.

PRESENT CONCEPTS OF THE ORIGIN AND TREATMENT OF TRAUMATIC SHOCK

Collective Review

WILLIAM DEWITT ANDRUS, M.D., New York, New York

THE term "shock" has been used for almost one hundred and fifty years to describe a clinical picture easily recognizable when fully developed, but despite an enormous amount of work appearing in literally hundreds of publications, its causes and accompaniments are as yet not completely understood. This is perhaps not surprising since we are dealing with a profound biological reaction effecting most if not all of the physiological systems of the body.

Until the final decade of the last century most of the writings on shock were descriptions of its more obvious clinical features, combined with theoretical explanations of the signs and symptoms on the basis of the then current knowledge, with particular emphasis upon the exhaustion of normal physiological mechanisms. The theory of vasomotor exhaustion gained impetus from the work and publications of Crile beginning about 1900 and from the support of Lockhart-Mummery in England. Later workers have shown, however, that the vasomotor mechanism, far from being exhausted, probably is in a state of hyperactivity until late in the picture when the condition becomes irreversible by any means now at our command.

From about 1900 experimental work on shock as a physiological problem was enormously increased, although several valuable laboratory studies had appeared before that time. The most notable of these in the light of the present concept of the condition was the work of Sherrington and Copeman (125) who demonstrated the increase in specific gravity of the blood in experimental shock in animals. This they and Lockhart-Mummery (89) later confirmed in patients and found most evident in operations involving the peritoneum, large denuded areas, and in burns.

The casualties of the first World War gave added stimulus to the study of the problem, which continued into the early 1920's with the toxemia theory of shock receiving the most attention. The past twelve years have been marked by more intensive studies on patients and in laboratory animals, and have yielded some new facts which supported or disproved older work on the subject. The casualties of the present war, including as they do far more widely diversified types of patients, are presenting some new problems. Thus, while in the last war the casualties were almost entirely confined to men in previous good health and in the prime of life, those now encountered in bombed cities include children and the aged as well as many individuals in various degrees of health—with hypertension or other circulatory disorders.

The search for a single causative factor in shock has been fruitless so far, and the many attempts to define the condition—a recent reviewer (72) in an admittedly incomplete list collected 24 definitions—have failed to yield a single one which is completely satisfactory. The obvious and, we believe, the correct inference to be drawn is that the clinical syndrome which we call shock represents a very fundamental biological phenomenon complicated not only in its causal factors but also in the responses of the various physiological mechanisms and systems of the body. From these responses certain similar clinical pictures emerge which are quite definite when well developed, and to some extent they can be correlated with precipitating factors.

It has been customary in the past to distinguish between primary shock and secondary shock. The former is practically synonymous with syncope and its prototype is seen in the sudden fall in blood pressure which occasionally follows incision of the peritoneum. It is usually transient and recovered from spontaneously, and would seem best explained by reflex vasodilatation or inhibition of the normal vasoconstrictor tone of the blood vessels. If of longer duration, however, there is some evidence to indicate that it may pass over into so-called secondary shock, which is of graver import and more commonly progressive unless actively combated. Traumatic and postoperative shock are of the latter variety, as is that following burns and certain forms of toxemia. This division has been criticized as it is held that the two vary only in duration, although from the

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clinical standpoint the division is tenable despite the somewhat different initial mechanisms.

All studies on shock in experimental animals are handicapped by several factors and it is accurate to say that by no means yet available can shock of uniform degree or exactly resembling that in man be reproduced. Not only do similar degrees of injury produce different degrees of shock in any series of laboratory animals, but the added factor of anesthesia introduces a complicating element in all. The two greatest needs at present in the study of shock are methods of repeatedly producing shock of predetermined degree and a more practical method of measuring blood flow in various parts of the body without the complication of passive hyperemia or of the actual removal of any quantity of blood from the circulation.

In view of the various phenomena associated with shock, attempts have been made to separate them into those responsible for its initiation, those which tend to sustain or perpetuate the condition when once initiated, and those which are merely its accompaniments. While such a division is very useful, it can be made only on quite arbitrary grounds, and clear-cut assignment of a given reaction to an individual category is seldom feasible. Vasoconstriction, for example, may be not only an initiating but a sustaining factor, and the same is true of several other phenomena. It is more profitable, perhaps, to consider the various reactions according to their time of appearance, for while this may vary in different cases, those appearing early in the picture are likely to be of greater etiological significance.

It can be said with considerable accuracy that shock is a type of peripheral circulatory failure, and while different mechanisms may be at fault in its production, all ultimately lead to some characteristic alterations in the normal physiological processes. A constant and early discernible finding in shock is a diminution in the effective circulating volume of the blood, or oligemia. This may obviously result from an actual diminution in the volume of the blood in circulation, from an increase in the size of the vascular bed, or from both in combination, and it produces a situation in which, as Blalock (20) has emphasized, there is "a decrease in the ratio of the blood in circulation to the size of the vascular bed." When the reduction in effective blood volume follows hemorrhage, its cause is evident, but in other types the explanation is less satisfactory. In the case of shock following hemorrhage, oligemia is to be looked upon as an initiating factor, and in this type as well as in shock of other etiology it appears as probably a most important mechanism responsible for sustaining or perpetuating the condition.

The question as to whether shock following hemorrhage should be distinguished from that due to other causes has been the subject of considerable controversy which it does not seem profitable to review here. Suffice it to say that the experience of clinicians certainly favors the point of view that, so far as the syndrome and treatment are concerned, hemorrhage produces a condition so similar to oligemia from other sources that such a distinction is unimportant.

When a definite decrease in the effective blood volume has taken place, a train of events is set in motion which is easier to visualize and is more completely accepted from experimental and clinical observations, but uncontrovertible proof of the mechanisms whereby this condition is initiated still remains to be found. Several theories are current at present—no one of them supported by conclusive evidence and all subject to certain definite limitations—which separately or in some cases at least in combination, seem to offer the best explanations of the initiation of shock. In considering them we must admit that we are simply discussing something which precedes the oligemia present when shock is well developed, and it is quite possible that future studies with more refined techniques will disclose still earlier findings, by which the onset of shock may be foretold.

LOCAL FLUID LOSS AND OLIGEMIA

The concept of hemoconcentration in toxic shock is a very old one and was suggested by the apparent thickness of the blood in patients dying of cholera. The recognition of its presence, in the sense of increased specific gravity, in traumatic shock dates from the work of Sherrington and Copeman (125) who demonstrated it in 1893 in animals. They, and Lockhart-Mummery later, confirmed this finding in patients, noting that it was most marked in operations involving the peritoneum or large denuded areas and in burns. Roy and Cobbett (119), in experiments including laparotomies with manipulation of the intestines and in some cases resection, found a very considerable increase in the specific gravity of the blood. They also noted that when such blood was centrifuged the amount of plasma was seen to be diminished by as much as one-third. There is no evidence, however, that these authors considered the hemoconcentration as an initiating factor; rather, it was looked upon, by Lockhart-Mummery at least, as a secondary effect of the

vasomotor exhaustion which he considered as the fundamental cause.

The first clear-cut recognition of the importance of oligemia as a major factor in the initiation of shock with a suggested explanation of its origin appeared in 1913. Short (127) in that year, after reviewing the then current theories, believed that too little stress had been laid in the initiation of shock on the oligemia or concentration of the blood resulting from loss of fluid into the tissues and the injured area. In the general loss of fluid he stressed leakage from the capillaries in consequence of reflex vasoconstriction due to stimulation of the pressor afferent nerves.

Mann (96) in 1914 emphasized the significance of the loss of circulating fluid in shock following exposure of the abdominal viscera, and Robertson and Bock (116), and Keith (83) noted the reduction of blood volume, determined by the dye method, in traumatic shock in man, regarding it as a factor of primary importance in the outcome. Doubt was thrown on the significance of local fluid loss in traumatic shock by animal experiments of Cannon and Bayliss (34) in which after death from shock due to trauma to the muscles of one thigh, both thighs were skinned and removed symmetrically by disarticulation at the knees and at the hips and their weights compared. The difference was too small to represent the extravasation of a sufficient amount of blood to cause shock. Repetition of these experiments in 1930 by Blalock (21), and by Parsons and Phemister (106) with bisection of larger portions of the posterior half of the body showed, however, that when the tissues of the hips and flanks (into which blood may also be extravasated) are included, the increase in weight of the traumatized part represents a proportion of the total blood volume capable of producing severe shock. In such experiments the increase in the weight of the traumatized limb was always more than that of the amount of blood which if withdrawn intermittently over the course of an hour would cause the death of the animal.

The degree to which such local loss of blood into injured tissues is responsible for the oligemia of traumatic shock in patients is uncertain but it seems likely that in many it is the most important factor. In addition to shock following trauma to tissues, Harkins and Harmon (74) list, among other conditions in which plasma-like fluid is lost from the blood stream, burns, freezing, bile peritonitis, tissue autolysis *in vivo*, acute pancreatitis, pneumonia and pulmonary edema, intestinal manipulation, and portal and mesenteric obstruction. In all of these conditions, if occurring with sufficient rapidity, a shock-like state may be encountered, although in several, agencies other than mere fluid loss are concerned.

VASOCONSTRICTION

Another factor which has been widely held to be of importance in the initiation of shock is vasoconstriction, a feature to which attention was first drawn by the blanching of the skin in this condition. Early supporters of the idea were Mapother (97) and Malcolm (95). This theory gained prominence as that of vasomotor exhaustion declined, and Malcolm, on the basis of purely clinical observations, held that the findings in shock were much more easily explained when associated with vasoconstriction. This author also stressed the significance of fluid loss but attributed the loss to the expression of liquid from the circulation due to constriction of the vessels. Many workers, including Seelig and Lyon (124), Pilcher and Sollmann (108), Bartlett (12), Erlanger, Gesell, and Gasser (53), and Burch and Harrison (29), demonstrated vasoconstriction in shock following trauma and hemorrhage; and Bainbridge and Trevan (7), and Erlanger and Gasser (52) produced shock by means of injections of adrenaline. Freeman (57, 59) believes that vasoconstriction is not only an accompanying but an initiating factor in shock and has shown (60) that prolonged activity of the sympathetic nervous system in the normal animal results in a decrease of the blood volume, but that following complete sympathectomy this finding is absent.

Recently the importance of vasoconstriction as an initiating factor in shock has been challenged by Hamlin and Gregersen (71), and by Wiggers (147). The former criticized the experiments of those who have produced shock by means of intravenous injections of adrenaline on the basis that the amounts required were well beyond physiological limits. Wiggers (148) criticizes the vasoconstriction theory of the origin of shock on several counts; namely, that it has not been demonstrated that the total resistance to the outflow of blood from the aorta is increased in early shock; that experimental and clinical hypertension in which total peripheral resistance is increased does not result in shock; that shock has not been produced by prolonged vasoconstriction due to stimulation of the sympathetics; and, finally, that the doses of adrenaline which are assumed to cause shock themselves produce deleterious effects on the heart after withdrawal, viz., on the coronary circulation. The same author points out that vasoconstriction in certain regions, that is, the

skin, liver, etc., may quite as well be a compensatory mechanism for maintaining the circulatory volume through the viscera as for the initiation of shock.

We are left with the feeling that while vasoconstriction may be present in certain regions of the body, its role as an initiating factor in shock is by no means clear.

In certain cases of acute shock, and particularly in those following sudden painful stimuli or spinal anesthesia, it seems quite certain that the peripheral vessels are dilated. The same is true in experimental shock following the injection of histamine or other tissue extractives which produce their effects by direct peripheral action. Goltz (69) in 1864 showed that a sudden blow on the mesentery of the frog caused a general decrease in vascular tone and reflex inhibition of the heart. Some of these effects are of reflex origin and, unless maintained for too long a period, are ordinarily recovered from spontaneously.

DIMINISHED BLOOD FLOW

An important result of the factors discussed above is a diminished volume flow of blood. While the mechanisms of its production may differ somewhat, the ultimate effects are similar. In oligemia due to hemorrhage and contributed to by dehydration; excessive vomiting; seeping of plasma from wounds, burns, and through mesothelial surfaces; or from direct trauma; the effective circulating volume of blood is directly reduced, and with this the volume flow. In the case of primary vasodilatation, capillaries ordinarily closed become patent, and to a certain degree and in restricted regions this is a normal mechanism for supplying increased circulation in response to need, viz., in muscular activity; but when a more widespread area is involved, the arterial pressure falls and the venous flow is reduced.

Vasoconstriction may cause capillary stagnation also, for as the *vis a tergo* furnished by the normal arterial inflow is lost, stasis in the capillary bed may take place, with consequent reduction in the amount of blood returning to the heart through the veins. It is interesting to note that diminished blood flow is not an accompaniment of the vasoconstriction in experimental and clinical hypertension.

Although the explanation of its source may not be entirely clear, there is ample evidence to indicate that an early and constant feature of shock is a diminished volume flow of blood. To a certain extent variations in flow are constantly occurring in the body under normal conditions, as a response to the physiological needs of various organs, but in shock the diminution is so widespread as to be definitely pathological. In a series of perfusion experiments in shocked animals, in which the hind leg, kidneys, and that portion of the gut supplied by the inferior mesenteric artery were used as regions for study, Morison and Hooker (102) in 1915 noted that the rate of flow under a constant head of pressure was decreased in all but 1 of 10 experiments, and that in the 1 instance, in which the nerves to the perfused part were sectioned, the flow was markedly increased. Aub and Cunningham (6) also noted a marked slowing of the blood flow in cats during shock. Somewhat different findings were reported by Penfield (107) in perfusing the hind limb with saline solution after the blood pressure had fallen to 40 mm. Hg as a result of massive bleeding. Although there was a diminished volume flow at first, this was later displaced by an increase of as much as one-third in the late stages of the experiment. The explanation of these divergent results probably lies in the fact that Penfield's animals had been bled to a greater degree than is commonly undertaken—in some experiments as much as three-fourths of the calculated blood volume—and were in very profound shock. Most writers are in agreement that vasomotor tone is markedly relaxed in the terminal stages of shock.

Gesell (64–68) in a series of articles, the first of which was written in 1918, made most important contributions to the study of blood flow in hemorrhage and in shock. His investigations were initiated by observations on the blood flow through a salivary gland, but were carefully controlled and led to very significant findings. Among the most important were the following, first, that diminished blood flow was a constant accompaniment of hemorrhage and shock because of tissue abuse, and, second, that the diminution in flow definitely preceded the fall in blood pressure. Indeed, as much as 60 per cent decrease in the blood flow could take place from a loss of 10 per cent of the blood volume without any change in pressure, or even in the presence of a slight rise. He noted further that a decrease in blood flow of as much as 90 per cent was seen before the blood pressure fell to the shock level.

Blalock and Levy (25) by means of outflow measurements showed that hemorrhage and intestinal trauma resulted in a striking diminution of blood flow, which, however, varied in different regions. Thus, the decrease was greatest in the posterior part of the body, amounting to an average of 73 per cent; was next most marked, 39 per cent, in the area draining into the superior vena cava; and not quite as great, 24 per cent, in the

liver and kidney. The discrepancy in the different regions was more uniform, from 36 to 47 per cent, in various regions in histamine shock. Further evidence along this line has been furnished by the work of Freeman and his coworkers (61), Roome (117, 118) and others. Roome (117), and Cammer and Griffith (32) observed the effect of intra-arterial injection of adrenaline on the blood flow—a condition similar by analogy to the vasoconstriction seen in some forms of shock—and noted a marked diminution.

Confirmatory and quantitative evidence from shocked patients has been contributed by Freeman, Shaw, and Snyder (62) who measured the blood flow through the hand by means of the plethysmograph, and found a very considerable decrease from normal levels.

Unfortunately, we have no direct and entirely satisfactory means of measuring the blood flow in patients and such methods are greatly needed.

NUTRITIONAL DISTURBANCES

Diminished volume flow of the blood, from whatever cause, is followed by a sequence of nutritional disturbances in the tissues bordering on the blood stream. The degree of correlation between the blood flow and the availability of nutrient elements is not clear, but Gesell (68), who felt that shock represents a combined circulatory and nutritional disturbance, stressed the importance of recognizing the seriousness of impairment of the circulation to an organ by introducing the concept of nutrient flow, i.e., the blood flow to an organ multiplied by the concentration of a given nutrient substance in that blood. While the concept is useful, its accuracy depends upon the recognition of certain variables for a substance like oxygen, since the curve of dissociation of hemoglobin is by no means a straight line and is affected by other factors than mere oxygen content, such as carbon dioxide concentration.

ANOXIA

Among the most important effects of diminished flow are those due to anoxia. Aub and Cunningham (6) in 1920 noted the marked lowering of the oxygen content of the venous blood in their shocked cats and this has been confirmed in patients by Freeman, Shaw, and Snyder (62) in connection with their studies of blood flow through the hand in shock. Krogh (86) in 1922 emphasized the importance of anoxia both as a cause of dilatation of the capillaries and as a factor in the production of increased permeability with consequent plasma loss. This has been nicely demonstrated by Landis (87) who observed the fluid movement through the wall of individual capillaries, and found that when the oxygen supply was withdrawn for as long as three minutes, fluid escaped from the vessel at about four times the normal rate. Because of this increased permeability, protein was also lost from the blood stream; thereby effective osmotic pressure of the remaining plasma was diminished. In his experiments, the normal permeability could be restored within fifteen minutes following the reinstitution of the normal blood supply. Increase in carbon dioxide concentration or of the pH within physiological limits caused no demonstrable change in permeability.

DECREASED OXYGEN CONSUMPTION

It was early noted by Aub (5) that the basal metabolism was markedly lowered in shock, and Gesell, Blair, and Trotter (66) found a fall in oxygen consumption of 29 per cent in dogs after hemorrhage. Schlomovitz, Ronzone, and Schlomovitz (120) confirmed the fall in oxygen consumption, but their experiments, which involved repeated small hemorrhages, indicated that this did not take place *pari-passu* with the bleeding but became marked when blood representing more than from 1.5 to 2.5 per cent of the body weight had been removed. Davis (39) reached similar conclusions, and Price, Hanlon, Longmire, and Metcalf (109) noted decreased oxygen uptake indicating anoxia of mounting severity.

There would seem, therefore, to be fairly uniform agreement that oxygen utilization is diminished in shock, and this is at least inferential evidence of decreased metabolism. To what extent this is a sustaining factor in shock and to what it is merely an accompaniment is by no means certain, but as will be brought out in consideration of therapy, utilization of oxygen may be increased as the condition is rectified.

ROLE OF THE ADRENAL GLANDS

The role of the adrenal glands in shock has been the subject of many investigations. That of the medulla has been stressed for many years as the source of adrenaline and has received renewed attention with the revival of interest in vasoconstriction. The fact that a shocklike state can be produced by continued injections of adrenaline (7, 52) has been interpreted as supporting the theory that vasoconstriction due to adrenal medullary overactivity is an important factor in the initiation of shock. One of the earlier proponents of this idea was Bedford (16) in 1917. Freeman (58) and Gale (63) showed that the blood sugar is elevated in shock and this is accepted in some

quarters as indicating adrenal overactivity. Certainly, there is much evidence pointing to overactivity of the sympathetic nervous system and vasoconstriction as may be caused by the adrenals in shock, and in this sense the adrenal glands may be an important initiating and sustaining factor.

The adrenal cortex, with its functions of regulating the electrolyte balance of the body, particularly as regards the sodium and potassium, and of influencing in some manner the permeability of the cells, including those of the capillaries, may play an important part in the production of certain of the phenomena observed in shock. Recent work indicates also that it may be of considerable significance as an adjunct in the therapy. A striking comparison of the findings in shock and in acute adrenocortical insufficiency was presented by Swingle and his coworkers (137) showing that except for the low blood sugar in the latter, the two conditions were highly similar. In a series of papers these authors (133–141) called attention to the increased susceptibility of adrenalectomized animals to shock produced by a variety of agents. It remains to be proved, however, that adrenocortical insufficiency actually occurs in shock, despite the similarity of the findings noted above, although of interest in this regard is the finding of Weil and Browne (145) who noted an increased excretion of the cortical hormone in the urine following surgical procedures. It can quite as well be said that adrenalectomy is one of the procedures producing a shocklike state.

The exact nature of the connection between possible adrenal insufficiency and shock is not clear, but that such a connection exists may be supported by three lines of reasoning. First, adrenalectomy causes death, according to Swingle and his coworkers (136), because of "capillary atony, with resulting dilatation, stasis, and peripheral vascular stagnation." Second, the structure of the adrenal glands and their blood supply, which makes them with the thyroid the most vascular organs of the body, might be supposed also to render them one of the first tissues to be affected by diminution of the blood flow. And finally, there is some evidence (77, 113) to indicate that in the presence of increased capillary permeability the administration of cortical hormone simultaneously with transfusions of blood or plasma may increase materially their effectiveness by retaining the fluid in the blood stream. It may be postulated on theoretical grounds that relative lack of the adrenal hormone may be associated with the point at which irreversibility of the shock picture occurs, although direct evidence on this point is lacking as yet. Indirect support of the idea is seen in the work of Rhoads, Wolff, and Lee (113) who found that the period of increased capillary permeability and plasma loss in burns could be materially shortened by the administration of adrenocortical hormone.

TOXEMIA

The theory of toxemia in traumatic shock, first seriously promulgated by Quénu (110) and by Cannon and Bayliss (34), although not widely accepted today, cannot be entirely dismissed for toxins may play some role in certain types of shock. Histamine derived from traumatized tissue was first held suspect since many of the signs of shock could be reproduced by its injection. Much of the experimental support for these conclusions was removed, however, by the experiments of Blalock (21) and of Parsons and Phemister (106) who demonstrated that the extravasation which takes place into the traumatized area will suffice alone to explain the shock which follows. Dragstedt and Mead (46) showed that while the lymph from the thoracic duct of dogs in shock following the injection of histamine contained the substance in readily detectable amounts, that of dogs in shock following trauma failed to show it or any other vasodepressor substance. Barsoum and his coworkers (8, 9, 10, 11), utilizing an improved method of estimating the amount of histamine in the blood, found it to be increased after certain types of injury, notably after the release of a tourniquet placed on an extremity and in burns, but were unable to correlate the amount present with the clinical findings. Indeed, the greatest concentration was noted in burns a considerable time after injury and long after shock is usually encountered.

In view of the work of Lewis (88) on the "triple response" of vessels to various types of injury with his suggestion that the local dilatation is due to a hypothetical H (histamine-like) substance, the possibility that some tissue metabolites may be responsible has been entertained. Such a point of view is included in Moon's thesis (101) that the "wheal is shock in miniature."

In certain forms of shock, i.e., those associated with definite infection or tissue lysis, there can be little doubt that circulating toxins may exert a powerful effect in their production through direct action on capillary endothelium. The failure as yet to identify a similar toxic substance in cases of traumatic shock should not lead to its exclusion as a possible causative factor.

Scudder and his coworkers (121, 123, 151) have advanced the thesis that potassium, which they

have found to be markedly increased in shock associated with a variety of conditions such as crushing of tissue, intestinal manipulation, acute pancreatitis, intestinal obstruction, and hemorrhage, may be responsible for the development of the shock. Cutler and Pijoan (38) in 1937 had noted such a concentration of potassium in animals with intestinal obstruction. Other writers (18) in repeating such experiments as those of Scudder found no constant change in plasma potassium, and Swingle and his coworkers (136) noted a rise in blood potassium in but 2 of 6 adrenalectomized animals with shock due to intestinal stripping, and in these the rise did not correspond to the degree of shock. In some of Scudder's experiments hemoconcentration preceded changes in the potassium concentration, a fact making the importance of increased potassium as an initiating factor at least questionable.

From this and other work, it seems evident that an increase in blood potassium may be present in shock, but the lack of uniformity in this finding as well as of correlation of the increases when present with the degree of shock, casts doubt upon its importance as a causal factor. The burden of evidence would seem to indicate that the increased blood potassium is perhaps a result of the grave alterations in cell permeability encountered in this condition, and that it may play some role as a sustaining or perpetuating factor.

NOCICEPTIVE NERVOUS STIMULI

The importance of painful stimuli is seen in the primary fall in blood pressure encountered in patients immediately after the free perforation of a peptic ulcer, or occasionally on incision of the peritoneum. The role of such impulses in the production of shock after trauma, however, has been the subject of considerable investigation without conclusive evidence having been produced in either direction. It will be recalled that the early work of Crile on shock attributed its origin to exhaustion of the vasomotor centers by nociceptive impulses, and that it was this concept which led to his championing of the combination of local and general anesthesia to which he gave the name "anoci association." While there is at present ample experimental work indicating that the vasomotor mechanism is not paralyzed either centrally or peripherally except in the terminal stages of shock, and that the changes in the cells of the central nervous system interpreted by Crile as indicative of exhaustion are better explained on other grounds, for example as due to anoxia, the concept that painful or visceral afferent impulses are influential in the production of shock merits serious consideration. It is probably correct to assume that the degree to which such stimuli influence the production of shock will vary considerably from case to case, because both the mass of these impulses and the individual's susceptibility to them will differ. It may be that herein lies an explanation of the experience of many clinicians, that a given individual may go into profound shock from what appears to have been a relatively minor injury, whereas another may fail to do so after a more extensive one.

It is generally accepted that the primary and most potent factor in the production of shock by trauma to an extremity is local fluid loss into the injured area, and that the nociceptive stimuli are of secondary importance. Evaluation of the relative importance of these two factors is extremely difficult, and to date there is little unequivocal evidence for the production of shock in such experiments by nociceptive stimuli alone.

Simonart (128) found that shock was not produced in the course of an hour and a quarter after crushing of a denervated limb of a cat, while similar injury to an intact limb produced it. O'Shaugnessy and Slome (105, 129, 130) found in cats anesthetized by chloralose and with interruption of the nerve supply to a limb that the usual trauma was followed by milder shock than was the case when the nerve supply was intact. Further, shock followed trauma to the extremity of a cat which received its circulation from the donor animal. From these studies they inferred that a barrage of impulses originating in the traumatized limb was responsible for at least a part of the shock produced, and by appropriate technique were able to record such a barrage in animals whose limbs were perfused during the experiments. The barrage was a relatively late phenomenon, however, and this fact led to their concluding, "The initial depressor effect of trauma is due to fluid loss; the significant decline to shock is caused by the continued and continuous discharge of impulses from the traumatized area."

Experiments of other workers have yielded controversial evidence on this point. Lorber, Kabat, and Welte (90) were able to produce shock by trauma to the perfused isolated hind limb whose nerve supply was intact, and noted that while chloralose increased the susceptibility of such animals, similar results could be obtained under ether anesthesia. In our own laboratory we have at times been able to produce a decline of blood pressure to the shock level by the perfusion of a limb completely isolated except for its nerve supply, with physiological solutions of low oxygen content. This has followed in about one quarter

of the experiments but never in the controls, and requires further work before accurate conclusions can be drawn. It has served to indicate to us, however, the great complexity of such experiments and the importance of being sure that the isolated limb is not anesthetic.

Evidence against the importance of nervous impulses is seen in the work by Cannon and Bayliss (34), Parsons and Phemister (106), Freedlander and Lenhart (56), Holt and MacDonald (80), and Blalock and Cressman (24). All of these authors have been able to produce shock in animals in which the nerve supply to the limbs had been interrupted in various ways. Blalock and Cressman, and Holt and MacDonald also noted that chloralose anesthesia increased the susceptibility to shock.

It is to be noted that all experiments designed to test the relative importance of these factors are distinctly artificial. It has been possible to cause shock either by local fluid loss or by nociceptive impulses when the other was excluded, although the shock brought about by fluid loss is more uniform and more easily produced. In the traumatized patient both may exert an influence, and while, of the two, fluid loss appears by far the more important, it is too early to exclude the other entirely.

TREATMENT

The conditions of the present war have introduced problems in the treatment of traumatic shock which, while recognized in the prevention and care of postoperative shock, have been less prominent in previous wars. The situation is now more nearly comparable, so far as the age and previous condition of the victims are concerned, to the accident service of a large hospital rather than to the condition behind the lines in the last war when the casualties were from a narrower age group and the individuals, except for fatigue and some dehydration, had been previously in very good physical condition. The principles of treatment remain very much the same, however, and the changes are largely confined to modern techniques in applying them.

Rest. The first and perhaps the oldest principle in the prevention and treatment of shock remains that of putting the injured patient at rest. This involves measures directed at resting not only the patient as a whole but the injured member as well. No more striking result of such a simple principle can be imagined than that seen in the very considerable reduction in mortality of gunshot fractures of the femur in the last war which followed the immediate application of Thomas splints before transport. The maxim "splint them where they lie" is everlastingly important. This not only eases pain but lessens fluid loss by preventing excessive motion of the injured part. Rest and quiet are indispensable elements of therapy regardless of the theory of the origin of shock accepted.

Rest for the patient as a whole involves not only prevention of physical activity but also the amelioration of mental and emotional strain. Restlessness and anxious facies are cardinal features of shock and reflect deepseated stresses in the victim. For this as well as for the easing of pain, sedation is advisable, and morphine remains the most effective agent. In view of the relative anoxia often encountered, however, excessive dosages are to be avoided, and its use in head injuries with increased intracranial pressure is contraindicated. In such patients and in those in whom pain is not a feature, the barbiturates may be useful. Anesthesia for operative procedures should involve those agents which avoid diminishing the oxygen intake.

Warmth. Another very old and still important feature of the prevention and treatment of shock is the application of mild heat. This is based on the known deleterious effects of exposure to cold in facilitating the production of shock and the subnormal temperature seen in shocked patients. The usefulness and importance of warmth cannot be questioned, but its application can be harmful if carried to extremes since generalized exposure to too high temperatures may produce widespread superficial vasodilatation as well as increasing oxygen requirements in the presence of anoxemia. Excessive heat may also promote dehydration if it causes increased perspiration. Local application of heat, as with hot water bottles, may cause burns in a semicomatose patient.

The application of warmed blankets and the judicious use of hot water bottles suffices for the individual case and the electrically heated cage recently developed by the British may be useful. For the handling of large numbers of such patients it was the custom in certain evacuation hospitals in the last war to keep shock wards heated to a temperature of 85 degrees, and the measure would seem worth considering as an aid to keeping patients warm in emergencies requiring the handling of relatively large numbers of injured.

Vasoconstrictor drugs and stimulants. The rationale for the use of such drugs is the idea that the peripheral vessels are dilated in shock. While this may be the case in so-called primary shock and in that associated with spinal anesthesia or circulating toxins, in which case vasospastic drugs

may be useful, the burden of evidence indicates that vasoconstriction is the more uniform finding in traumatic shock or in that due to hemorrhage. Although widely recommended even before the first World War and still employed clinically today in the form of some of the newer preparations such as ephedrine and neosynephrine (82), the use of vasospastic drugs is distinctly questionable and should be discouraged in traumatic and hemorrhagic shock. If we recall the decreased blood flow which characterizes even the early stages of such shock, we will be slow to employ drugs which, while they may produce an elevation of the blood pressure, do so at the expense of a further diminution of the volume flow.

Dodd (44) in reviewing a variety of drugs used in surgical cases to elevate the blood pressure, including coramine, adrenaline, ephedrine, icoral, eserin, cortin, veritol, and cardiazol and veritol combined, found only ephedrine and veritol alone or combined with cardiazol of real value. From 0.75 to 1 cc. of veritol, B-p-oxyphenyl-isopropylmethylamine given intramuscularly produced a gradual rise beginning in from three to five minutes and reaching normal in about twenty minutes. This author expresses confidence in the usefulness and safety of this drug.

In many clinics caffeine was frequently employed as a stimulant in postoperative cases with impending or actual shock, and after considerable experience with it the writer feels that it is distinctly worth while, either given hypodermically or when conditions permit, mixed with saline solution and given per rectum. It seems entirely reasonable to suppose that its action in increasing blood flow may prevent or otherwise improve anoxia associated with capillary and proximal venular stagnation.

Position of the patient. It has long been customary to elevate the foot of the bed or stretcher of a patient in shock, with the idea that thereby the venous return to the heart may be increased. Although this idea is based largely on empirical clinical experience and has been questioned by some (33), it seems definitely beneficial in many cases, and with certain exceptions should be carried out. The exceptions are seen in cases of chest injuries and in some of head trauma, in which a head down or even a horizontal position may cause embarrassment to the respiration. In such cases the position must be regulated according to the needs of the patient.

Oxygen. There is considerable evidence that anoxia is responsible for many of the features of shock and in particular for the local tissue damage—as for example, the increased capillary permeability—which may account for the irreversibility of the picture in some cases. For this reason, the administration of oxygen to patients in shock would appear to be of great importance. In this condition both the means of transport, i.e., the blood plasma, is diminished, and the load per vehicle, i.e., the oxygen content of the corpuscles, is decreased. It is of obvious importance therefore to increase the oxygen content of the blood, at least until the means of transport again become efficient.

Wood, Mason, and Blalock (149) showed that the administration of oxygen in shock due to hemorrhage, histamine, or trauma brought about a marked increase in the oxygen available to the tissues as evidenced by increased oxygen content of the venous blood from the femoral, renal, and portal veins, as well as in the blood from the right heart. Schnedorf and Orr (126) in studying the effect of oxygen on the survival of dogs after trauma found that those receiving oxygen survived seven and seven-tenths hours, while the control group lived only four and one-half hours, although the amount of fluid loss into the traumatized tissues was approximately the same in the two groups. Davis (40) found oxygen therapy most useful in hemorrhagic shock after the cessation of hemorrhage, noting that it was less effective when bleeding or hemoconcentration was progressing.

The actual methods by which oxygen is administered must vary with the circumstances, but either tents or masks can be used. High concentrations of as much as from 80 to 90 per cent may be given with the B. L. Boothby mask. Too long exposure to constantly high concentrations of oxygen is not itself without danger, and the administration should be interrupted from time to time if the patient's condition permits. At the same time, it is obviously necessary to deal with any circumstances impeding the oxygen intake in so far as possible.

Adrenocortical hormone. While there has accumulated a considerable amount of evidence indicating both the decreased resistance of adrenalectomized animals to various types of injury and the definitely beneficial effects both in these and in normal animals from the injection of the hormone in enhancing resistance to various forms of toxemia, the role of the adrenocortical extract in the therapy of traumatic shock is not as yet clear.

In a series of experiments carried out on dogs we (77) were able to show that the simultaneous injection of adrenocortical hormone with such toxic substances as the aqueous extract of ob-

structed intestinal loops would markedly ameliorate or even prevent the shocklike state which otherwise followed. In this instance, as in shock following the injection of histamine, we are dealing with diminished plasma volume, the result of increased capillary permeability due to direct injury of the endothelium by the toxins. The most significant finding of the work was the demonstration that in the presence of such increased permeability any blood substitute, crystalloid, or protein administered alone also escaped from the circulation, but if adrenocortical hormone was given simultaneously with a transfusion of blood, this escape could be prevented and the blood volume restored. In this correction of increased permeability the adrenocortical hormone seems definitely to play a most important part.

In traumatic shock in animals previously adrenalectomized but kept on maintenance doses of the hormone its further administration seemed to exert a markedly beneficial effect (136). Weil, Rose, and Browne (146) noted a considerable lowering of mortality in shock following intestinal manipulation in previously normal rabbits anesthetized with ether, and found cortical extract more potent in lessening or preventing shock than desoxycorticosterone acetate alone or in combination with smaller doses of cortin.

More recently Rhoads, Wolff, and Lee (113) noted in a control series of burns, to which plasma alone was administered, that the loss of plasma from the blood stream, presumably due to increased capillary permeability, persisted for an average of forty hours, whereas the combined administration of plasma and cortical extract (eschatin) markedly shortened this period and tended to cause a retention of the infused plasma within the circulation. The giving of the hormone alone was ineffective. The clinical results obtained by these authors are similar to those seen in our experiments on animals already discussed.

Rhoads, Wolff, and Lee comment on the fact that such increased permeability may occur as the result of stagnant anoxia in traumatic shock and suggest the usefulness of an agent which may shorten this period of stagnant anoxia by making transfusion more effective. We are in agreement in pointing out the need of furnishing an adequate and continued supply of the hormone—either by repeated injection or by giving it over longer periods combined with a more or less continuous transfusion.

In summary, then, it would seem highly probable that the administration of adrenocortical hormone is a valuable adjunct to transfusions of plasma in making the latter more effective in the presence of increased capillary permeability due to anoxia or to the direct effects of toxins. It is possible that it may also be useful in preventing or lessening the degree of such increased permeability if administered early.

Great reserve should be exercised in accepting the role of the hormone in the prevention of traumatic or surgical shock until considerably greater series of well controlled cases can be presented.

Fluid administration. Although long recognized as of great importance, the establishment of oligemia as perhaps the most obvious factor in the production and perpetuation of shock after trauma and hemorrhage has re-emphasized the replenishment of the blood volume as the paramount objective in the handling of shock cases. The advances since the last war in this regard have been largely along the lines of indicating improved methods of preparation of material and the better selection of blood substitutes for transfusion.

Oral administration of fluids to patients in shock is not only often unavailing so far as restoration of blood volume is concerned, but because of the frequent vomiting may not be well tolerated. This is, of course, in contrast to the situation in patients with a diminished blood volume from dehydration *per se*, in which the oral administration of fluids is most effective.

Subcutaneous or intramuscular infusions, while convenient, also are ineffective, since in the presence of hypotension the fluid may not be well absorbed. Both of these methods and in addition that of orajejunal feeding used by Ravdin, Stengel, and Prushankin (111) are effective means of the administration of fluids to dehydrated patients. The oral route is quite satisfactory in the restoration of the plasma proteins in cases of hypoproteinemia, but on the whole these methods are not directly applicable to the acute treatment of shock.

The replenishment of the blood volume by the intravenous route remains the primary method in this phase of shock treatment. All other methods of fluid administration are of definitely secondary importance.

The types of solutions available for intravenous infusion in patients are as follows:

1. Crystalloids—normal saline solution, Ringer's solution, glucose solution
2. Colloidal solutions—gum acacia, gelatin, etc.
3. Amino-acid solutions—casein digestate
4. Whole blood—fresh blood by direct transfusion, citrated fresh or preserved blood, placental blood
5. Plasma—fresh, preserved, or reconstituted
6. Serum—fresh, preserved, or reconstituted

Other solutions such as red-cell suspensions and hemoglobin—Ringer's have been suggested, but for various reasons—including the difficulty of preparation and certain detrimental side effects—have been largely discarded in the treatment of shock.

1. The usual crystalloid solutions used are normal sodium chloride solution, Ringer's solution, and glucose solution. All have the advantage of low cost, relative simplicity of preparation, ease of preservation, and lack of toxicity, but a great deal of evidence has accumulated which indicates their inefficacy or possibly even their detrimental effect in cases of profound shock. There can be little doubt that in many patients with impending shock or with a moderate fall in blood pressure following operation, the infusion of saline solution or a glucose saline mixture may be highly beneficial in restoring the blood pressure, but as a means of replacing the blood volume once a true oligemia with increased capillary permeability has occurred, they are much less desirable. Otherwise stated, the more urgent the need for restoring blood volume, the less effective are the crystalloid solutions and the more transient are any benefits obtained. This is attested by a number of observers (1, 3, 73, 80, 85, 86, 98, 108, 114, 142).

A feature making the use of crystalloid infusions even less desirable in shock from various causes was stressed by Blalock and Beard and their coworkers (13, 14, 15, 22, 23, 26) who showed that such infusions increased the amount of protein escaping from the blood stream, and thereby actually exerted a seriously detrimental effect. This has been confirmed by Minot and Dodd (99, 100) and by Harkins (75).

It may be emphasized, therefore, that while crystalloid infusions have a definite place in the treatment of dehydration and may often be beneficial in aiding to prevent shock from more limited trauma, their use in cases of profound shock may be not only ineffective but actually detrimental.

2. In the colloidal group of solutions may be included gum acacia, gelatin, pectin, etc. While gum acacia, particularly, enjoyed considerable popularity during the last war, further studies have indicated its undesirability as a blood substitute. This is due chiefly to the fact that it may exert detrimental effects on the blood vessels (47), and has frequently been found to be toxic (35, 37, 42, 70, 132). Further, it is extensively deposited in the liver where it may remain for long periods (4, 84).

A solution of gelatin in saline solution was used by Hogan (79) during the past war and has been recently employed in animal experiments by Chambers (36). Its usefulness, however, cannot yet be said to have been established.

3. When casein, which contains all of the essential amino-acids, is subjected to digestion by papain, a material is obtained which in 5 per cent solution is well tolerated when injected intravenously, intramuscularly, or beneath the skin. This mode of therapy, particularly as it relates to the restoration of plasma proteins, was studied by Elman and Weiner (51), Farr, Emerson, and Futcher (54), and by Elman (49, 50). Madden and his coworkers (93) and Madden (92) conclude that the intravenous or hypodermic administration of such material actually promotes the production of new plasma proteins.

The three classes of solutions mentioned, while useful and sufficient for certain purposes, can be considered as far less desirable in the presence of true oligemia or hemoconcentration. For the correction of true oligemia nothing yet devised can be considered as satisfactory as blood elements, either as whole blood or as plasma or serum.

4. In patients with anemia or very considerable hemorrhage, whole blood is definitely preferable to any other fluid, but in those in whom oligemia or hemoconcentration are the important indication plasma or serum may be highly beneficial. Black and Smith (19) in connection with the treatment of bleeding-ulcer cases suggest that plasma is contraindicated when the hemoglobin level is less than 50 per cent. The best rule to follow would seem to be to substitute what is lost. Thus, in burns with high hemoglobin values and hemoconcentration due to plasma loss, plasma is directly indicated, while in cases of hemorrhage whole blood is the fluid of choice for infusion. Because of the greater simplicity of plasma administration, its availability and the fact that cross-matching is unnecessary when taken from several donors, it will undoubtedly find a greater field of usefulness in any acute emergency.

Fresh blood, in the sense of unaltered whole blood, may be given directly by the multiple syringe technique, but its range of usefulness is narrowed by the practical difficulties attending its use and especially because it presents no real advantages over citrated blood.

By far the greater number of whole-blood transfusions are now given by the indirect method in which sodium citrate is used as the anticoagulant. The advantages of this method are so numerous and so well known as not to require enumeration; they include simplicity, ease of transportation, and preservation up to a point. Robertson (115) advocated the use of preserved blood

with a mixture of dextrose and sodium citrate as an anticoagulant, and reported successful results with blood which had been preserved in this way for as long as twenty-six days. The idea of the storage of blood received further support from the work of Yudin (150) with cadaver blood and of Novikova and Farberova (104) with placental blood. In the Spanish Civil War the high proportion of air-raid casualties requiring transfusion emphasized the need for ample supplies of blood or blood substitutes, and this experience has been repeated in England where it is estimated that transfusion is urgently indicated in at least 10 per cent of such patients.

The idea of a blood "bank," in which serologically negative blood of any group could be deposited and that of the specific group required for a transfusion withdrawn, originated at the Cook County Hospital in Chicago, and is now carried out in most of the larger hospitals in the country. As experience with the method has increased, certain facts regarding it have emerged, so that at the present time the routine may be said to be well established.

Certain changes take place in stored blood, however, and while some of them do not materially affect its usefulness, they must be borne in mind. Thus, DeGowin, Harris, and Plass (41) noted that the potassium content of stored blood was considerably increased, but concluded that if it was given slowly this was not a serious detriment. Downman, Oliver, and Young (45) in England also noted this rise in potassium, to from five to ten times the normal within a week, and found it to be independent of hemolysis.

While it is of little importance in the absence of prothrombin deficiency in the recipient, there is evidence to indicate that the prothrombin content of preserved blood is definitely depressed. Rhoads and Panzer (112) found levels below 30 per cent after one week by Quick's method. Lord and Pastore (91) showed, however, that in preservation with careful control of refrigeration between 2 and 4°C. the fall was much less rapid, and that the prothrombin level determined by the method of Warner, Brinkhous, and Smith (144) remained above 75 per cent for at least nine days, and above 50 per cent for as long as three weeks.

Studies of the electrophoretic patterns of preserved blood (122) indicate that certain alterations take place in the blood proteins on standing, but their exact significance is not yet evident.

In general, whole blood which is preserved for longer than ten days is definitely less desirable for transfusion both for the reasons outlined and because hemolysis tends to take place in an increasing degree after that time. This, then, has become the time limit of preservation of whole blood in most clinics, but under war conditions it may be increased without too much danger. Citrated whole blood under refrigeration is not materially damaged by transport during this period. In most active blood banks it is customary to use blood older than ten days as an additional source of plasma, so that it is not wasted.

In the blood bank of the New York Hospital the blood is citrated and kept in storage for ten days between 2 and 4°C., and more than 3,600 transfusions have been furnished from this source during the past year.

5. and 6. Ward (143) in March, 1918, suggested the clinical use of citrated plasma as a substitute for whole blood, and his ideas have found confirmation and elaboration more recently. Its advantages are several and include availability, relative ease of preservation, and elimination of the need for matching when pooled plasma or serum are used, as well as a high degree of efficiency in shock cases. As has been noted, there are certain instances, as for example, in severe hemorrhage, in which whole blood seems definitely more beneficial than plasma or serum, but even in such instances, for reasons to be presented, the fluid elements of the blood may be of great aid. In the presence of hemoconcentration with elevated hemoglobin values, plasma or serum are indicated, while whole blood is much less effective.

Not only do plasma and serum provide a medium to carry the corpuscles and thereby decrease anoxia, but as has been shown by Brennan (27), they may serve to mobilize corpuscles and actually increase the red blood-cell count. This writer has shown that the red cells are increased in size after hemorrhage and hence may become sequestered in the smaller vessels, but that following plasma transfusions they are again freed. In 1 experiment the red blood-cell count previously depressed to 3,400,000 by hemorrhage was increased by 1,200,000 after plasma transfusion.

Several formulas have been presented for calculating the dosage of plasma, serum, or blood deemed necessary for the restoration of the blood volume. Among these the methods of Elkinton, Wolff, and Lee (48), Bushby, Kekwick, and Whitby (30), and of Hill (78) should be mentioned. All are essentially means of calculating the existing blood volume, taking into consideration also the hemoglobin concentration, and comparing these with the normal values for a patient of given weight. Scudder and others have employed measurements of the specific gravity of the blood as a means of following the effects of transfusions of

plasma or serum and thereby estimating the amount to be given.

While such formulas are of undoubted value, it should always be borne in mind that until the integrity of the vascular system has been restored something more than mathematical replacement of the blood volume is required. It is frequently necessary, therefore, to administer more than the theoretically required amount to bring about a recovery. Indeed, some of the most spectacular results have followed relatively massive transfusions.

Plasma versus Serum. In large clinics where blood banks are active, considerable quantities of natural plasma are obtainable by utilizing blood more than five to ten days old as its source. Such plasma can be preserved by refrigeration at 2°C., or even maintained in a frozen state at lower temperatures for a considerable period of time; it is simply warmed to body temperature, immediately before injection. There seems to be little use of natural serum at present, but dried or reconstituted serum is employed by some.

Both plasma and serum have certain advantages as well as recognized defects. Thus, plasma was found by Buttle, Kekwick, and Schweitzer (31) to be effective in bringing about recovery in cats after hemorrhage, while serum produced only transient benefit. Plasma, on the other hand, is prone to develop clots on standing and requires filtration before it is added to the circulation. Serum appears to give more reactions because of the presence in it of substances producing vasomotor effects. This is attested by Amberson (3), Doan (43), Brodin and Saint Girons (28), Strumia, Wagner, and Monaghan (131).

While both plasma and serum can be kept in the frozen state for considerable periods of time where proper facilities are available, the exigencies of war both in the field and in civilian areas make preservation in the dried state much more desirable. It seems likely, therefore, that except for certain civilian hospitals, most plasma and serum will be given after being reconstituted from the dried state by means of distilled water.

A number of methods for drying plasma or serum have been evolved, including the lyophile process of Mudd and his coworkers (103). Flosdorf and Mudd (55) introduced the cryochem process, consisting in vacuum drying from the frozen state with calcium sulphate as the refrigerant. Harkins (72) had listed some 21 methods of preparing dried plasma or serum, the 3 chief classifications being spray distillation in vacuum, evaporation from the frozen state, and drying through cellophane membrane. Reference should be made to his review or to the original articles for details of the methods. All are somewhat cumbersome and this processing would seem likely to be the greatest bottleneck in the production of large quantities for the armed forces and civilian casualty units. For this reason, hospitals, except those possessing means for drying plasma or serum, will continue to use the natural elements or preserve them by refrigeration.

A live question concerns the use of isotonic versus hypertonic plasma or serum. In general, it would appear best always to use an isotonic fluid for intravenous injection and this would seem particularly important in patients such as soldiers in the field in whom more or less dehydration may be present. Certainly there can be no serious quarrel with the rule always to use isotonic fluids when possible.

The arguments for the use of hypertonic plasma or serum, i.e., desiccated and reconstituted to twice or four times normal strength, rest on the demonstrated efficiency of such material in restoring the plasma proteins in nephrosis (2), and in elevating the blood pressure in certain types of experimental shock. Thus, Best and Solandt (17) found that serum three times stronger than isotonic was most effective in this regard in shock due to histamine, trauma, and trauma and hemorrhage. Magladery, Solandt, and Best (94) found, however, that in hemorrhagic shock isotonic serum was quite as effective as concentrated serum and that plasma and serum produced comparable results.

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SURGICAL TECHNIQUE

WAR SURGERY

Duenner, R. H.: Medical Service of the Armored Force. *Mil. Surgeon*, 1942, 90: 300.

The outstanding characteristics of the armored force are: (1) its high degree of mobility (2) its tremendous fire power, (3) its great maneuverability, (4) its high striking power, and (5) its armor. Medical services must be supplied for the following missions: rapid seizure of critical areas, envelopment or encirclement; a break through a gap in the enemy line; exploitation of penetration; and pursuit.

To provide medical service for the armored division, the old plans for evacuation and treatment must be discarded. It is not feasible to establish battalion or regimental aid stations, or to utilize the old shuttle system of ambulance transfer. More personal control, more personal supervision by officers and noncommissioned officers, and logical thinking and common sense are requisites for successful medical service for these forces.

The function of the medical detachments of the major elements of the division are briefly described:

Infantry regiment (*armored*). No radical change has been made. Two company aid men are attached to each company. Litter bearers evacuate casualties to the battalion aid stations and evacuation continues via ambulance. The ambulances for front-line use are half-tracked armored vehicles fitted with litter braces.

Armored regiment. This is comprised of three battalions composed of three tank companies each and a headquarters company. It is impracticable to assign medical personnel to ride in the tanks because of lack of room. Medical personnel must follow along the central axis of evacuation collecting casualties en route. At designated rallying points, casualties are removed from tanks and evacuated to the rear. Tank crews are trained to use the vehicular first-aid kits, and to remove patients from tanks with minimal additional injury. The medical personnel following up the axis of evacuation are supplied with armored half-track personnel carries described above. Battalion aid stations are not set up and a collecting point is designated from which evacuation is carried out via ambulances to the clearing station.

Reconnaissance battalion. This unit operates so widely that medical service must be performed only for its own detachment, which is consequently rather large. Contact is kept via radio.

Field artillery battalion (*armored*). A battalion aid station is installed but no litter bearers are required. Evacuation from the aid station devolves upon the collecting personnel.

Engineer battalion (*armored*). This has an unusually large medical detachment because of the frequently exposed nature of its operations. Company aid men are assigned, and the ambulances recommended are the half-track type, armored, which have already been described.

Ordnance battalion (*armored*). The medical personnel is composed of litter bearers and ambulances, and accompanies this unit and removes casualties from disabled tanks.

Medical battalion (*armored*). This is composed of a headquarters company, one collecting company and one clearing company. It is designed to function in lieu of duties formerly performed by collecting stations. Equipment consists of fast moving armored ambulances and small vehicles for carrying medical personnel.

Finally, the author believes that the clearing company should be lifted from its stabilized status and mounted on trucks. The "surgical" truck is undergoing experimental development. These changes are required of the medical detachments supporting the armored force because of the mobile type of present warfare. LUTHER H. WOLFF, M.D.

Rank, B. K.: Base Hospital Management of Soft Tissue Injuries. *Australian & New Zealand J. Surg.*, 1942, 11: 171.

In as far as many battle casualties are still potential fighting men, this article offers suggestions for cutting down the healing time of war wounds. Rank endorses continued passive management of soft-tissue wounds treated in forward battle areas following surgical débridement and closed plasters. Its effectiveness and suitability to mobile war conditions are well established. Prolonged immobilization in itself, however, may not be conducive to rapid healing. The poor quality of skin which regenerates under the plaster, and the thick, indurated keloidal type of scar might be avoided by secondary suturing or skin grafting.

"Chronic wounds" cause an undue amount of hospitalization. Bone sepsis, tendon sloughing, and, especially, retained foreign bodies are well known local causes of delayed healing. Poor general conditions may be contributing factors.

It is now further evident that a no less important cause of delayed healing of wounds is secondary streptococcal infection. It is not unusual to have 70 per cent of the wounds in a ward of war casualties infected with streptococcal organisms. Ninety-eight per cent of desert sores are streptococcal infections, and the healing time taken by some of these is notorious. The streptococcus organism may so often persist on what are thought to be healthy wounds; and its capacity to inhibit epithelial proliferation is becoming increasingly appreciated. So-called "healthy" granulation is commonly associated with gross hemolytic streptococcal organisms. Not only is spontaneous healing inhibited, but secondary surgical procedures are rendered ineffective and perhaps dangerous.

Attention is drawn to the uniformly good results which now can be obtained by secondary grafting of granulating wounds which have been properly cleared of streptococcal infection by the local application of sulfanilamide. The value of the ability to eliminate surface streptococcal infection in war surgery must be fully recognized.

The active management of soft-tissue injuries consists of bacteriological examination for the presence of streptococcal infection, and roentgenography to rule out any possible retained foreign fragment. If the injury is more than 6 in. square, a blood transfusion is always given.

A routine preparation, irrespective of the type of healing of the wound, includes saline immersions. An ingenious improvised set-up for sustaining the proper hypertonicity and temperature of these baths is portrayed. After the bath, the wound is dressed once daily. The dressing consists of a tulle gras, or cotton curtain netting, which is placed over the wound area after sulfanilamide powder has been insufflated from a blower. Moist saline packs are then applied and held in place by gauze bandage. The dressing is kept moist all day by irrigation with normal saline solution; it is not permitted to dry.

In cases in which streptococci are not present, eusol packs are used outside the tulle gras and kept moist by the application of eusol and saline solution. In the case of streptococcus pyocyaneus, a 2 per cent acetic-acid solution is used. The dressing is kept moist in a similar manner. Small wounds are exposed to direct sunlight daily after the saline baths.

When the wound is adequately cleaned, skin grafting is done. The health of the wound is judged by its active skin edges. Only two types of grafting are applicable to general wounds: pinch grafts and razor grafts.

The care of these grafts consists of pressure dressing left undisturbed for five days. Then subsequent reapplication of a pressure dressing every day. When healing is complete, the areas are massaged lightly every day with lanoline, and full functional exercises are carried out in bed. Fifty skin graft cases were thus treated, with only 2 unqualified failures.

STEPHEN A. ZIEMAN, M.D.

Littlejohn, C. W. B.: Report on the Early Treatment and Results of Penetrating Wounds of the Chest. *Australian & New Zealand J. Surg.*, 1942, 11: 147.

Littlejohn describes the management and results of the first 100 cases of penetrating wounds of the chest treated in an Australian General hospital. It was found that soldiers with chest wounds who received immediate attention in the field had a better prognosis. Consequently, most of the sucking wounds are now sutured in the forward battle areas, usually without any formal excision of the skin edges or devitalized tissue. Closure of the defect is accomplished with silkworm-gut sutures passed through deeply and tied firmly. Movement of the patient is restricted to an absolute minimum, and many patients are retained for days in the resuscitation ward. Unfortunately, a large number of casualties had multiple wounds which greatly jeopardized their lives. An analysis of the cases reviewed showed that only 7 deaths occurred which could be attributed solely to chest wounds. There were 21 due to all causes.

Every patient was placed on a sulfonamide which usually consisted of 2 tablets of sulfanilamide four times a day, with 4 tablets for the first dose and 3 tablets for the second. Patients unable to take the drug orally received 2 gm. of sulfapyridine daily by intramuscular injection.

Very few of the patients were in a condition to withstand early operative interference, consequently only 3 operations were undertaken. The optimum time for operation, even for removal of a foreign body, is considered to be in the second week.

It was concluded that sucking wounds must be sutured and not packed, and a minimum of interference is advised. Even aspiration should be performed only when there is an appreciable amount of fluid in the chest.

STEPHEN A. ZIEMAN, M.D.

Gordon-Taylor, G.: Abdominal Injuries in Modern Warfare. *Brit. M. J.*, 1942, 1: 366.

This report is based upon a series of more than 600 operations for abdominal injury among the casualties from Dunkirk, the Navy, and the R.A.F., as well as from air-raid casualties among civilians. Most of the penetrating injuries of the abdomen were caused by fragments of bomb casing. Bullet wounds, flying glass, stones, and metal wounds were also common. Viscera were found to be injured by in-driven bone fragments, although the missile itself may have failed to penetrate the abdominal cavity. The importance of the buttock as the site of the wound of entrance cannot be stressed too strongly. In 20 per cent of all cases of abdominal injury the object entered through the buttock. The minute wound of entrance was also of considerable importance. Small wounds were detected by cutting away the clothing and examining the patient all over the body. A patient with a large wound of the abdomen or a wide loss of the abdominal wall seldom recovered. The general condition of the patients varied widely from extreme shock to the ability to walk and help their fellows. Primary hemorrhage was a predominant cause of death in the early hours of wounding, but secondary hemorrhage was rare.

The prognosis in lesions of the stomach was better than that which prevailed in the last war. Prolapse of abdominal viscera made the patient a bad surgical risk. The mortality rate for prolapsed nonperforated small intestines was 50 per cent; when the gut was also injured the mortality rate was 80 per cent. In prolapse of the large bowel the prognosis was very grave, but some recoveries occurred in cases in which the large bowel had been both prolapsed and lacerated. Suture of bowel lacerations was associated with better results than was resection, and most of the resections of the bowel in patients who survived, had been of short lengths.

Several successful operations for wounds of the duodenum were carried out. The recovery rate in cases of injury of the rectum was 52 per cent, a decided improvement over the 35 per cent rate of the last war; while the recovery rate in penetrating wounds of the bladder was slightly lower than the 40 per cent rate in the last war. The spleen was frequently injured by penetrating wounds and by falls in the black-out. "Immersion blast" was known to naval surgeons in the last war, but more attention has now been drawn to this injury. These cases varied from mere ileus to peritonitis following rupture of the intestine.

Despite the gravity of the wounds and the frequent association of multiple injuries, about 50 per cent of all patients with abdominal wounds from enemy action for whom operation was possible survived. The recovery rate was 40 per cent following operations for injuries to the large bowel, and 64 per cent when the injuries were confined to the small bowel. Exteriorization operations on the large bowel were unsatisfactory. Sulfonamides given locally and orally proved to be of inestimable value. Blood and plasma transfusions were employed on a liberal scale and made a host of cases operable.

JOHN L. LINDQUIST, M. D.

Breden, N. P., D'Abreu, A. L., and King, D. P.: Sudden Compression Injuries of the Abdomen at Sea. *Brit. M. J.*, 1942, 1: 144.

There have been many reports since the beginning of the present war on the effects of blast injuries to the lungs, but the reports on the effects of sudden compression of the abdomen have been few and brief.

The authors report the clinical course of this condition as observed in the cases of 10 sailors who had been injured at sea, all but one of whom were subjected to the effects of detonations of depth charges while in the water. The one was trapped in a compartment when his ship was torpedoed.

The case histories fall into 3 groups: (1) obvious abdominal injury with complete recovery, without operation; (2) severe injuries, such as lacerations, disclosed at operation (1 case); and (3) late complications such as abscess formation. These groupings, however, are but variations of the entity.

The immediate effects of the blast were not severe and in each case the patient was able to walk to his cabin. Within an hour or so there was abdominal pain, tenderness, varying degrees of rigidity, melena, and hematemesis. The temperature was elevated somewhat, as was the pulse. A complaint of bilateral testicular pain was common. There were no external markings or bruises of any kind.

The pathology consisted of subperitoneal and submucus hemorrhages, and lacerations of the intestines. The chief effects of the injury were limited to the abdomen. No solid organs showed injury.

With conservative management, consisting of supportive measures and sedatives, the patients made a slow but gradual recovery. The 1 death in the series occurred following laparotomy for a laceration of the intestine with spreading peritonitis. Death was thought to be due to the blast injury of the lungs, since this patient had been the only one who was not in the water when injured.

None of the patients was seen in the first twenty-four hours; therefore the authors cannot assess the indications for immediate operation. The results of this series, however, justify the adoption of conservative management of such cases, especially if seen after a period of twenty-four hours.

ROBERT D. MANSFIELD, M.D.

Smith, J.: Surgical Experiences in the Middle East. *Australian & New Zealand J. Surg.*, 1942, 11: 153.

This article deals briefly with the possibilities of surgery on the battlefield, and the conditions under which, at times, it must be performed. The experience was gained on the African Western Desert, and in the Syrian campaign. It describes the equipment at the disposal of the surgical team, and emphasizes the importance of a smoothly coordinated surgical team, the selection of the personnel of which requires considerable deliberation. It describes the duties of each individual before, during, and after the battle. The day before the battle, considerable time is spent in collecting blood from the sick wastage or walking wounded which may be passing through the main dressing station. The writer believes whole blood is preferable to dry serum or plasma for a man who has suffered severe blood loss, when the replacement of oxygen-carrying material is essential.

Ether was the anesthetic of choice, while pentothal-sodium was used extensively for short operations. Spinal anesthesia had no place in the set-up.

The general treatment of wounds consisted in thorough débridement, which may include splitting of the deep fascia against its fibers to explore the depth of a penetrating wound. Sulfonamides were used locally on all open wounds as well as administered orally. Four tablets of sulfanilamide were given on admission, followed by 2 tablets every four hours. Among the 1,500 battle casualties treated during the Syrian campaign, there were no cases of gas gangrene which developed in the casualty station, a fact attributed to the use of sulfanilamide. The wound toilet consisted in the performance of débridement, instillation of sulfonamide powder, and the application of a large blob of vaseline to the wound, which was then covered with several layers of gauze as a flat dressing. Immobilization of the wounded part by enclosure in plaster was resorted to as often as considered practicable.

In the summarization of the wounds treated, some interesting facts stand out. One might imagine that the average war wound is a large and terrifying affair. On the contrary, the majority of the wounds may be described as quite minor. The occasional horrible extensive mutilation in men who survive to reach surgical aid is the exception.

The number of wounds of the abdomen which had to be treated were small and comparatively rare. They provide, however, the only justification for forward operating teams, since these are one type of wounds which must be dealt with as soon as possible. Perforations and intra-abdominal injuries were repaired, and the abdomen was closed in layers. The results of this type of injury give considerable concern. Among the 19 wounds of the abdomen operated upon, only 9 recoveries are recorded, a fact attributable to the ten-hour or longer delay in the patient's reaching the operating table. Fortunately, this type of wound forms rather less than 1 per cent of battle casualties. Wounds of the upper portion of the abdomen are less critical than those of the middle or lower part, while wounds of the large intestine are associated with a very high mortality.

Chest wounds are serious problems, but certainly on the average, not so serious as abdominal wounds, and recovery is much more frequent. Among the 1,500 casualties, there were approximately 30 uncomplicated cases of penetrating thoracic wounds.

Penetrating wounds of the head are treated as compound fractures of the skull with removal of the loose bone down to an intact dura, and if the foreign body fragments are small, they are usually left undisturbed for later removal by a brain surgeon.

Compound fractures of the different bones are then considered with little contribution added to the ways and means of treating them. The wound is incised, thoroughly explored, irrigated with hot saline solution, swabbed with acriflavine, and then dried. A sulfonamide powder is evenly distributed throughout the cavity and a blob of vaseline introduced. A flat gauze dressing is applied. In the case of fractured femurs, a Thomas splint with skeletal traction by means of a Kirschner wire and stirrup facilitated the transportation and the evacuation of the patient to a rear hospital. Fractures of the humerus are treated according to their site, and immobilized by means of a plaster slab that extends from the base of the neck over the shoulder and scapular region and along the posteroexternal border of the limb.

STEPHEN A. ZIEMAN, M.D.

ANTISEPTIC SURGERY; TREATMENT OF WOUNDS AND INFECTIONS

Gudin, M.: The Third Phase of Surgery. *Ann. Surg.*, 1942, 115: 452.

Surgery is now entering upon the third phase of its evolution with respect to the problem of infection. The first phase was the period of complete ignorance of the existence of bacteria. Wound infection was accepted as a concomitant of healing, and surgical skill aimed at satisfactory healing by secondary intention. In the second phase the action of bacteria on wounds was recognized, and surgery was done in a manner to prevent infection and to achieve healing by primary intention. In the third phase the surgeon recognizes so-called healing by primary intention in its present form as a more or less septic process. The wound heals by primary intention in spite of contamination, and the author believes that 90 per cent of what is called postoperative illness is due to infection in wounds that are considered clean. The evidences of contamination in primary healing are: (1) the inflammatory reaction; (2) the tendency of hematomas to suppurate; (3) the lack of tolerance for foreign bodies; and (4) the more or less frequent necessity for drainage. The author's concept of the third phase is "total sterilization," which promotes a type of healing previously unknown—"Pasteurian cicatrization."

Fig. 1. The surgeon completely protected by the sterile suit. (Courtesy of J. B. Lippincott Co.)

The exogenous factors of operative contamination under present conditions are: the patient's skin, the surgeon's hands, the perspiration of both, the operative equipment, and the air. Ordinary bacteriological methods fail to demonstrate these factors decisively because of the obstacle of air contamination in bacteriological technique. The author's experiments were performed under protection from contamination by air. They show among other things that normal skin can be made sterile if the environment is sterile.

The reason for the failure of previous attempts to sterilize the air of operating rooms depends upon two principles: "It is impossible to introduce a sterile substance into a container contaminated by bacteria without contaminating the substance," and the process of sterilization must "succeed in sterilizing container and content simultaneously." The use of ultraviolet rays involves many complex problems to achieve sterilization of the air and the entire surgical environment. The author's method of "integral asepsis" employs an apparatus enclosed in

a hermetically sealed operating room and controlled electrically from the outside. Formaldehyde is evaporated into the room and fans circulate the air so that no living thing can survive. The formaldehyde is removed by its combination with ammonia, and the excess of gases is removed by bubbling the air through tartaric-acid solution. The entire operating environment is then sterile and the air can be breathed.

His operating room is isolated from the outside by four sterile anterooms equipped with sterilizing air conditioners. Surgeons and patients are dressed in the anterooms in sterile overall gowns which cover the entire body before they enter the operating room (Fig. 1). The patient is brought in already anesthetized, and the operative materials are attached to the table. The surgeons' hands are scrubbed, in sterile air, with sterile hot water, soap, and brushes for ten minutes. Sweating is prevented by air conditioning. Strict silence is observed to avoid contamination through the masks. To the objections of expense and difficulty the same answer can be given that was given to the objections against the introduction of present day aseptic technique and rubber gloves. By these methods sterile surgery can be done in a sterile environment, and a new type of wound healing has been observed.

JOHN L. LINDQUIST, M.D.

ANESTHESIA

Dafoe, C. S.: Anesthetics and Shock. *Anes. & Anal.*, 1942, 21: 114.

The author observes that at the termination of the last war there was a widespread belief among anesthetists that nitrous oxide was a safer anesthetic than ether for patients who were suffering from shock.

An experimental study was made testing the effects of three anesthetic agents in animals previously shocked and in normal animals.

Rabbits were used for the study. Shock was produced by a combination of bleeding from the jugular vein and stripping of the intestines with a rubber covered clamp for a period of one-half hour.

A control group of 36 animals was shocked under intravenous pentothal sodium, and in addition three other groups of normal animals were anesthetized only with the three agents respectively.

Ether was given by the open drop method with fairly rapid induction.

A mixture of 95 per cent nitrous oxide and 5 per cent oxygen was given with a mask.

Cyclopropane was administered by a rebreathing method, a high percentage being given at first and the concentration adjusted later to maintain surgical anesthesia.

The animals were allowed to die or recover and the mortality figures were analyzed statistically.

In comparing the mortality of shocked animals alone and of those receiving the various anesthetics, a significant effect of ether was noted. When the differences between the percentage mortalities with the three anesthetics on shocked animals were studied statistically it could not be shown that any significant differences were attained.

ROBERT D. MANSFIELD, M.D.

White, J. C., Verlot, M., Selverstone, B., and Beecher, H. K.: Changes in Brain Volume During Anesthesia. The Effects of Anoxia and Hypercapnia. *Arch. Surg.*, 1942, 44: 1.

The authors performed experiments on cats to learn more about the factors which cause swelling of the brain in the course of intracranial operations. They have developed quantitative methods and other procedures which facilitate the study of changes in brain volume. The following factors may produce enlargement of the brain: engorgement of the vascular tree; escape of fluid from the capillaries into the entercellular spaces (edema); swelling of the nerve and glial cells; and increase in the size of the ventricles.

In normal adult cats not under anesthesia the percentage of difference between cranial capacity and brain volume (differential index of brain volume) is 10.5. In man it varies from 2.5 in infancy, to 15 in old age (senile atrophy). In pathological human brains it varies from 29.3 in cerebral atrophy to the other extreme in a patient with epilepsy whose edematous brain fills the entire cranium. In cats under pentobarbital-sodium anesthesia, in which an open airway was maintained, the differential index of brain volume remained approximately the same as in the unanesthetized cat. When a cat under pentobarbital-sodium anesthesia was made to breathe a nitrogen-oxygen mixture containing less than 10 per cent oxygen, a striking increase in the volume of the brain occurred. The differential index fell to 6.55 per cent. The maximal swelling may occur whenever the oxygen in the inspired air drops below 10 per cent, and at any oxygen saturation of the arterial blood under 80 per cent. Increasing the carbon dioxide in the inspired air up to 10 per cent does not cause any additional swelling of the anoxic brain. Under ether anesthesia the differential index of brain volume behaved as in pentobarbital-sodium anesthesia. Nitrous-oxide anesthesia, on the other hand, causes a drop of the index to around 7 per cent because of swelling of the brain.

The residual volume of blood in the brain of the cat after decapitation and drainage of the head is about 0.2 cc. The blood content of the anoxic and of the normally oxygenated unexsanguinated brain is the same in the animal anesthetized with pentobarbital sodium as in the normal animal. In animals under ether anesthesia it runs a good 0.2 cc. higher. This is due to the vasodilator effect of the ether on the pial vessels. This degree of added vascular engorgement (less than 1 per cent of the total brain volume) is too slight to be noticeable during intracranial operations. Anoxia is not a cause of cerebral congestion. Hypercapnia, increase in the carbon-dioxide tension, is a most effective vasodilator. In

a subject anesthetized locally as well as with pentobarbital sodium or ether, the brain fills approximately 91 per cent of the cranial cavity. In a subject under ether anesthesia with an obstructed airway, in whom both anoxia and hypercapnia are present, the brain may fill nearly the entire cranial cavity.

No correlation was found between the cerebrospinal-fluid pressure and the degree of cerebral swelling during uncomplicated anoxia. No correlation was apparent between the changes observed in spinal-fluid pressure and the changes in the systemic arterial pressure. Although the authors were not able to demonstrate consistent lasting elevation of the cerebrospinal-fluid pressure in uncomplicated anoxia, they obtained a spectacular rise in the pressure when the carbon-dioxide tension of the inspired air was raised.

Anoxia and increase in the carbon-dioxide tension are important causes of swelling and congestion of the brain. In anoxia, the permeability of the capillaries is increased and the fluid leaves the blood stream and enters the tissues. This occurs throughout the body. Acute pulmonary edema, so often seen in patients dying of head injuries and brain tumors, is probably another manifestation of increased permeability of the capillaries during anoxia. Nitrous oxide should never be used as the sole anesthetic agent for craniotomies. When general anesthesia is used for intracranial operations the intratracheal tube should be used routinely. If necessary to combat respiratory failure, artificial respiration by intermittent insufflation of oxygen through the tube can be used.

Adequate oxygenation of patients with head injuries when cerebral swelling is present, is important. In cerebral injuries in man the oxygen saturation of the arterial blood may fall far below the critical level, at which level loss of fluid from the capillaries begins to take place. Nearly all patients who died were in this group, while those with an oxygen saturation above the critical level recovered. The realization that reduction in the oxygen content of the inspired air is dangerous in cases of head injury has an important wartime bearing on the evacuation by airplane of persons with such injuries. Definite changes in the volume of the cranial contents probably begins to take place somewhere in the neighborhood of 11,000 feet, where the atmospheric oxygen is reduced to about 15 volumes per cent. At this level arterial oxygen saturation drops to around 85 per cent in normal persons. When brain swelling is already present, its further increase by anoxia constitutes a serious risk. DAVID J. IMPASTATO, M.D.

PHYSICOCHEMICAL METHODS IN SURGERY

ROENTGENOLOGY

Vanzant, B. T.: Roentgen Therapy in Hereditary Diffuse Polyposis of the Colon. *J. Am. M. Ass.*, 1942, 118: 875.

Because of the mildness of the early symptoms the patient with polyposis of the colon is not likely to present himself for examination and treatment until a number of years have passed, or perhaps until some of the polyps have already undergone malignant change. The percentage of long-term survivals following either medical or surgical treatment is very low. However, surgical cures are possible in some cases by means of radical surgery.

In extensive cases, removal of the entire colon is necessary. This usually entails a multiple-stage procedure over a period from six months to one or more years. The mortality mounts with each successive stage even under ideal conditions.

There are ample theoretical grounds to justify the hope that roentgen therapy may prove to be valuable in every phase of the disease. As is well known, hyperplasia of lymphatic tissues and lymphatic infiltrations are peculiarly susceptible to irradiation. Both these conditions are characteristic features of this disease. If it is true that lymph-follicle hyperplasia is the initial step in the formation of polyps, it should be possible for the disease to be permanently arrested if patients are treated at this early stage. As was demonstrated by McKenney, many such preclinical cases could be uncovered by careful investigation of the relatives in known cases. Even after the lesions have advanced to the stage of mucosal hyperplasia and adenoma formation, the tissues are still radiosensitive because of their accelerated rate of growth and tendency toward dedifferentiation.

In the 2 cases reported, treatment consisted of high-voltage roentgen irradiation solely on the basis of theoretical reasoning. In both cases economic considerations made surgical treatment impossible. The results seemed encouraging enough to warrant further studies so that a fair evaluation of this treatment can be made. HAROLD LAUFMAN, M.D.

Kelly, J. F., and Dowell, D. A.: The X-Ray Treatment of Acute Peritonitis. *Radiology*, 1942, 38: 299.

The authors publish further data in support of the value of x-ray treatment of acute peritonitis of intestinal origin. The possibility of etiological similarity with gas-bacillus infection attributed to the presence of clostridium welchii and other anaerobes from the intestine is discussed. It seems, at least, that these two diseases have many identical clinical features and that both respond more promptly and consistently to x-ray irradiation than to any other therapeutic measure.

Of the various stages of peritonitis, only that secondary to appendicitis is considered in this article. The following clinical stages are distinguished:

A. Localized
   - First stage: appendicitis.
   - Second stage: appendicitis plus localized peritonitis, which may go through all stages of abscess formation.

B. Generalized
   - Third stage: early spreading peritonitis; serosanguineous stage, with blood and serum in the peritoneal cavity and over the loops of bowel, with probably a small amount of pus; no adhesions, since the serum has not yet coagulated and formed fibrinous bands between the various intestinal loops.
   - Fourth stage: fibrinopurulent stage. Blood is disappearing; serum is becoming fibrinous and thicker and is forming bands between loops of bowels; some pus is accumulating.
   - Fifth stage: many adhesions are present which are more or less organized and there is a profuse collection of pus with probably some localized abscesses from time to time.

The value and indications of x-ray treatment may be resumed as follows in these stages:

1. Appendicitis: surgical removal is the choice.

2. Appendicitis with localized peritonitis: here, too, as a rule x-ray therapy is not indicated.

3. Early acute spreading peritonitis in the serosanguineous stage: in this type of lesion the results of x-ray therapy are most spectacular. Treatment is indicated twice or three times the first day, twice the second and third days, and once each day thereafter until healing is accomplished.

4. Generalized peritonitis, fibrinopurulent stage: x-ray treatment in this stage helps to overcome toxemia, although the response is usually not so impressive as in the previous stage. Generally, with every additional day of delay the effect of the x-ray irradiation grows less.

5. Generalized peritonitis with adhesions and abscesses: the administration of x-ray therapy may already be too late to shorten the course of the disease, unless some control of the toxemia is desired.

A statistical analysis showed that 290 cases of peritonitis were observed by the authors from 1934 to 1940, inclusive. These were divided into 3 main groups:

1. Peritonitis localized to the region of the appendix—49 patients. All recovered regardless of what treatment they received in addition to surgery.

2. Peritonitis localized to the region of the appendix with abscess formation—39 patients. They also have all recovered.

3. Generalized peritonitis—202 patients. This group was divided into 4 subgroups, according to the therapeutic procedures applied: (a) general measures only—109 with 68.1 per cent mortality; (b) sulfanilamide and general measures—42 with 38 per cent mortality; (c) sulfanilamides, x-ray and general measures—21 with 33.3 per cent mortality and (d) x-rays and general measures—30 with 20 per cent mortality. The total mortality rate in the 51 patients who received x-ray therapy was 25.4 per cent as compared to 57.6 per cent of the remainder.

The technique of irradiation was briefly as follows: from 1 to 3 treatments per day at the bedside; from 50 to 75 roentgens per dose; from 90 to 130 kv., from 2 to 5 mm. of aluminum filter; and from 40 to 50 cm. distance. Special caution was exercised in young girls and pregnant women. Lately it was noted that the antagonistic action of the x-rays, which was observed for the sulfonamides, is considerably less or perhaps entirely missing for sulfathiazole.

All in all, it was found that the mortality rate of the cases irradiated was only one-half of that of the cases treated with sulfonamides internally and less than one-third of that of the cases treated with surgery and other general measures but without either x-rays or the sulfonamides. T. LEUCUTIA, M.D.

Senturia, H. R.: The Roentgen Findings in Increased Lead Absorption Due to Retained Projectiles. *Am. J. Roentgenol.*, 1942, 47: 381.

The literature relating to chronic lead poisoning as a result of projectiles retained in the body over a period of years, with and without reference to roentgen findings, is reviewed, and the author cites in detail several case histories reported by others, in which the roentgenograms showed findings which are being emphasized in this article. Two additional cases which were studied by the author are also reported at length, and numerous roentgenograms illustrating the findings described are included.

From a critical study of the reported cases, of which roentgenograms are reproduced, it is apparent that certain changes occur in the roentgen appearance of the retained missile which would indicate that absorption can occur and poisoning may supervene. From this standpoint, the roentgen examination may be of both diagnostic and prognostic value. Briefly, these findings consist in a definite change in the missile itself, in that there is fragmentation, disintegration, and apparent infiltration throughout the adjacent tissues. As the bullet originally is well defined and sharply delimited, the changes which occur result in a diffuse disintegration of the main body of the missile into numerous smaller particles, or into a homogeneous metallic diffusion which may be rather sharply encapsulated from the surrounding tissues; or, more likely, these particles infiltrate the surrounding tissues along the muscle, tendon, and fascial planes. The roentgen demonstration of such a transformation does not always coincide, as has been shown by analyses of specimens removed at operation, and at autopsy.

Projectiles such as infantry shot or shrapnel, consisting mainly of lead, are most likely to result in disintegration and absorption. The site of the embedded projectile is probably the most important factor leading to such results. Of the 9 cases reported in detail, all but one showed that the projectile was in the bone and adjacent to an active joint. Projectiles remaining in soft tissues have not been known to show these changes. The interval between the gun-shot wound and the onset of clinical symptoms varied in this series from one to twenty-two years.

The practical importance of the findings noted is that individuals who are known to have retained projectiles, especially in bone adjacent to active joints, should have serial roentgen examinations to detect such changes. Obscure and unexplainable symptoms referable to the blood, gastrointestinal tract, or nervous system may find their solution by this means. If changes occur in the projectile, demonstrable roentgenographically, then operation should be considered, even though no clinical or laboratory findings of chronic lead intoxication have been discovered. A. HARTUNG, M.D.

MISCELLANEOUS

Allen, F. M.: Reduced Temperatures in Surgery. Experiments on Pelvic and Abdominal Refrigeration, with Especial Reference to Traumatic and Military Surgery. *Am. J. Surg.*, 1942, 55: 451.

The use of refrigeration assumes particular significance in connection with traumatic and military surgery.

There are already some publications dealing with the value of the method in surgery of the limbs. From study of the available data the author finds that with refrigeration both arms or both legs can be amputated as high as a tourniquet can be placed. The greatest advantage is the reduction of shock to a minimum. If a tourniquet is applied for the temporary stopping of hemorrhage, refrigeration helps by depriving the limb or limbs of circulation for an increased time limit, and thus prevents devitalization and infection of the tissues.

In proceeding beyond the limbs there also seem to be several possibilities. The principal parts of the trunk to which refrigeration can be applied are the pelvis and abdomen. The author in the present article gives *in extenso* the results of his more recent experiments, which were carried out successfully on dogs, as cats were found unsuitable. These experiments included pelvic ligations, refrigeration of isolated intestine, and high abdominal ligations, and a number of biochemical and histopathological observations are given.

The following conclusions were reached:

1. Refrigeration permits stoppage of the circulation by a tourniquet or ligature in the region of the abdomen to be tolerated without fatal injury for

considerable periods; for example, more than six hours with stoppage just above the pelvis, three hours with stoppage just below the rib margin, and five hours with ligation of the entire free portion of the intestine alone. Large injections and irrigations of iced saline solution are a harmless and valuable aid in the refrigeration of such large tissue masses.

2. The entire condition and technique need to be further studied, but at present the most important known considerations for safety are efficient chilling to the nearest possible point above freezing, avoidance of trauma, and minimal time of operation, while osmotic and aseptic niceties are secondary. Along with the excellent preservation of tissue vitality, probably the most striking feature is the small risk in operating without asepsis and the effective cleansing of the peritoneum by iced saline flushing.

3. As the abdominal tourniquet is not unknown in surgery, the gist of this investigation is that low temperature greatly reduces local and constitutional injuries and dangers, the chief of which are shock, paraplegia, and enteritis. However, these effects are not wholly prevented, and this radical method is not calculated to replace ordinary surgical usage under ordinary circumstances. It appears worthy of clinical trial in conditions and emergencies which are otherwise hopeless, for example, in the severest hemorrhage, burns, and wounds of the lower part of the body. The procedure is most promising when limited to the hips and pelvis, reasonably hopeful if a damaged intestine can be kept cold while the body remains warm, and most difficult if approximately half of the total body mass along with the intestine must be kept cold. Granted that there is a high mortality among the cases which are inoperable by any other method, an experience with this type of surgery, especially in traumatic and military surgery, can furnish decisive data as to its value in abdominal conditions.

T. LEUCUTIA, M.D.

THE TREATMENT AND PREVENTION OF TETANUS

Collective Review

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IT is not a matter of great surprise that a disease with such dramatic manifestations as those of tetanus should have been recognized early, and both the systemic and the local varieties are accurately described in early medical writings. Not only does this disease affect members of the human race but our domestic animals are susceptible to it. Until 1884 the cause of tetanus was unknown, but in that year the transmissibility of the disease to animals was demonstrated by 2 Italian investigators. The causative organism was identified between the years 1884 and 1890. Ordinarily this organism is referred to as the bacillus tetani, but it is more correctly classified as the clostridium tetani. During the first World War there was great interest in tetanus because of the high incidence of the disease on the battlefields of Western Europe. The prophylactic use of antitetanic serum soon became mandatory. As the war progressed, great disappointment was caused by the apparent failure of antitetanic serum to lower the mortality of the disease once it had developed. Following the war there was no unusual interest in tetanus until the last few years when Abel (1–7) reported his studies on its pathogenesis. For thirty years before Abel's investigations there were 2 cardinal theories concerning tetanus that were universally accepted. The first was the unitary theory, which held that the disease was solely one of the central nervous system. The second was the nerve-carriage theory, propounded by Meyer, which maintained that tetanus toxin, unlike all other water-soluble toxins, reached the central nervous system through the peripheral nerves. Abel questioned the correctness of both of these theories and drew attention to the fact that the theory of neural transport of tetanus toxin rested on several unproved assumptions. In refutation he pointed out that there is no experimental evidence of the existence of currents of protoplasm within the axis cylinders; that the amount of toxin found in nerves excised from animals dying from tetanus is never of sufficient quantity to prove that the toxin is in the axis cylinders and not in the capillaries and lymph vessels of the nerve; and that there is no evidence that the perineural and endoneural lymphatics of the peripheral nerves communicate with the cerebrospinal fluid or cord; indeed, anatomists have shown the opposite to be true. In addition to these objections, Abel demonstrated the production of local tetanus in experimental animals by the intramuscular deposition of minute quantities of tetanus toxin at multiple points. As little as 1/8000 of the usual lethal dose of toxin, if placed in each of 40 different places in the muscles of a hind limb of an animal, renders that limb rigid for several weeks. This fact, however, is indirect evidence of the local action of tetanus toxin; subsequently Harvey (15), working at Hempstead, England, showed by oscillographic studies that the site of action in local tetanus is at the neuromuscular end organ. This direct proof by Harvey seems to make the unitary theory of tetanus untenable.

After Abel demonstrated the production of local tetanus by the multiple intramuscular injection method, an effort was made by his associates to produce separately the other cardinal manifestation of tetanus; namely, clonic convulsions. To do this, minute quantities of tetanus toxin were put into an anterior horn of the dog's spinal cord. It was found that following the injection there is a latent period free from any detectable changes. The deep reflexes then become hyperactive to the slightest sensory stimulus. It is possible to produce clonic movements in such a limb by gently blowing one's breath upon it. No evidences of unyielding rigidity (local tetanus) are observed in this experimentally produced central form of the disease.

It was during the performance of these experiments that a wholly unexpected discovery was made; namely, all of the animals died despite the fact that the amount of toxin injected into the lumbar cord was only a fraction of the ordinary intravenous lethal dose. It was found (9) that the intraspinal injection of as little as 1/400 of the usual lethal dose is always followed by the death of the animal even though the toxin is placed in a nonvital center, such as the lumbar cord. This unexpected result called for an explanation. Before reviewing the experiments (10) that were carried out to elucidate this phenomenon, it should be pointed out that it was observed in both tetanus-sensitive and tetanus-resistant species.

No other substance was found that gave a similar result, nor did death occur following the deposition of equally small amounts of toxin in other organs. Furthermore, it was shown that one can put into the lumbar cord an amount of tetanus toxin so small that no symptoms are detected and that, on the other hand, one can inject an amount that will produce clonic convulsions without the subsequent death of the animal. This relationship is in harmony with Abel's work in which he showed that when less than one-half of an ordinary intravenous lethal dose is given to an animal no symptoms occur, and that when one gives between one-half and less than the full lethal dose the animal has severe symptoms but recovers.

An explanation of death following the deposition of as little as 1/400 of the ordinary lethal dose of tetanus toxin in the lumbar cord is that the toxin passes up the spinal cord to reach the vital medullary centers. A series of experiments reported elsewhere shows that this is not the case because when the dorsal cord is transected above the point of injection the animals die, whereas similarly treated animals injected with boiled toxin do not die. Furthermore, if the toxin passes up the cord there should be a continuous progression of clonic movements, but no convulsions are seen in the head or the forelimbs of animals receiving lumbar-cord injections. Interestingly enough, our series of experiments with transected cords produced stiffness plus clonic convulsions in the hind limbs of injected animals, an observation which accounts for the mistaken interpretation given by Meyer of his experiments.

Another possible explanation of the death of the animals receiving intraspinal injections is that the persistent convulsive movements might produce some metabolite that causes death. This idea seems improbable because the animals receiving extremely small doses of toxin have convulsions for several days, while animals receiving extremely large doses have them only a few hours before death. To exclude this possibility we divided the low lumbar nerves and the conus and thus paralyzed the hind limbs. The tetanus toxin was then deposited in the lower segment of the lumbar cord, which was separated from all its peripheral connections. These paralyzed animals died as uniformly as those which had clonic convulsions.

A third possible explanation for death following an intraspinal injection of tetanus is that the toxin molecules are multiplied within the substance of the cord. To test the correctness of this assumption, we injected intravenously a large amount of antitoxin shortly before or just after the lumbar injection of tetanus toxin. The animals died despite the presence of many neutralizing doses of antitoxin in the circulating blood at the time of death. That the toxin is not multiplied and retained in the cord is proved by transplantation experiments and by assay of the injected segments of the cord. As a result of these experiments, we were led to suggest that the toxic molecule produced by clostridium tetani is probably altered within the substance of the nervous system to form a secondary toxic body, which in turn is absorbed by the blood. This secondary substance is not neutralized by ordinary tetanus antitoxin.

That death in tetanus is not due to a direct action of the ordinary tetanus toxin on the medullary centers is shown by a series of experiments in which these centers were injected with the toxin. For several hours after such an injection the animal seemed normal. Then followed a period of increased reflex excitability, and finally death. As a control for these experiments, similar injections were made with morphine sulphate, and within a very few minutes the depressing effect of this drug on the respiratory centers was evident and the animal died within half an hour. In an effort to obtain positive evidence of the existence of a secondary toxin, we carried out under anesthesia a series of cross-circulation experiments in which an active interchange of blood between an injected animal and a passively immunized one was maintained for several hours. The protocols of all of these experiments have been published. This study may be briefly summarized by saying that in 12 of 14 instances when cross circulation was performed following the development of convulsive seizures in the injected animals, the noninjected animals died. Furthermore, these animals died without any of the usual signs of tetanus. At the time of death the blood of both animals was assayed and found to contain large amounts of tetanus antitoxin. These experiments were carefully and adequately controlled. They seemed to support the theory that death in tetanus is due to the presence of a secondary toxic substance which circulates in the blood and which is not neutralized by tetanus antitoxin.

There is an alternative theory that is consistent with all the known facts. It is that tetanus toxin so alters parts of the central nervous system that this altered tissue removes from the blood some constituent (enzyme or hormone) that is essential for life.

The mode of death of the noninjected dogs in the cross-circulation experiments aroused our curiosity, for not only did these animals die without any of the usual evidence of tetanus, but it

seemed as if death was caused by respiratory failure. Moreover, it seemed that the lethal action of the hypothetical secondary toxin was enhanced by drugs that are respiratory depressants. This observation led to a series of experiments to determine the effect of various sedatives on animals with tetanus. It was shown that avertin and certain barbiturates, which are known to be respiratory depressants, will shorten the life of an animal with tetanus.

Our studies of the cause of death in tetanus led to certain subsidiary investigations (19). The results of these may be briefly summarized. First, we determined systematically the relative toxicity of tetanus toxin for various species. We also studied the relative effectiveness of this toxin when it was injected subcutaneously, intramuscularly, intravenously, intrathecally, and intraspinally (17). This investigation showed that tetanus toxin is slightly more potent when given subcutaneously or intramuscularly than when it is given intravenously. In the dog the lethal effect of tetanus toxin introduced into the spinal fluid is 20 times that of toxin given intravenously. Within the substances of the spinal cord, however, the toxin is several hundred times more potent than when it is given by other routes. An interesting and unexpected finding in these studies was that species susceptibility to tetanus toxin disappeared when the substance was placed in the spinal cord or in the medulla (22). In other words, the species susceptibility to tetanus depends on some mechanism within the animal that regulates the amount of toxin reaching the specifically reactive cells in the central nervous system.

In another series of experiments we studied the relative effectiveness of antitetanic serum when it is administered by various routes (20). To our surprise we found that the intrathecal route is more effective than any other in animals with early, mild, or moderate symptoms. In animals with really severe symptoms no form of therapy and no amount of antitoxin avail to save life. This result is in keeping with Abel's observation that once a lethal quantity of tetanus toxin has been fixed by the central nervous system, no amount of antitoxin will prevent death. It must be borne in mind, however, that severe symptoms can result from the fixation of less than a full lethal amount of toxin. Consequently, the presence of convulsions does not justify a physician in withholding vigorous treatment.

Our concept of the pathogenesis of tetanus is that the organisms multiply in necrotic tissue or in the presence of concomitant infection. The presence of spores of clostridium tetani in a sterile wound will not cause tetanus. When multiplying, the clostridium tetani liberate a water-soluble substance that diffuses through the adjacent skeletal muscles and acts on the neuromuscular end organs to cause a state of maintained contraction. This may persist for months, after which time the muscles return to a normal state. Some of the toxin substance passes into the lymphatics and blood stream from which a part is taken up by the specifically reactive cells in the cord and medulla and in the motor end organs of the skeletal muscles. In the central nervous system the toxin is probably altered to form a secondary substance that is not neutralized by antitetanic serum. This secondary substance circulates in the blood stream and seems to cause death by interference with some essential part of the respiratory mechanism. Once a lethal amount of this hypothetical toxin has been formed, no known treatment will save the life of the animal. This concept leads to the following recommendations for the treatment of this disease.

TREATMENT

Every effort must be made to establish the diagnosis of tetanus at the earliest possible time. Patients with suspicious trismus should be observed at frequent intervals and whenever possible admitted to a hospital. When the diagnosis is certain, the patient should be given an initial intravenous injection of at least 50,000 units of antitetanic serum for the purpose of neutralizing all of the toxin in the body which is still free and unaltered. Obviously, it is guesswork how much toxin is present in any given patient, but 50,000 units of antitetanic serum are sufficient to counteract the toxin in any patient who has a chance of recovery. It seems unnecessary to give enormous doses of antitoxin, for it has been shown experimentally that if one full lethal dose has been fixed and altered by the central nervous system, a million neutralizing doses of antitoxin will not save the animal. It must be emphasized, however, that one cannot tell whether the symptoms of central nervous intoxication are due to a fraction of a lethal dose or to several such doses. Therefore, it is imperative to give a fairly large initial intravenous dose of antitoxin, and thereafter to give daily injections of 5,000 units to insure the neutralization of any additional toxin that may be absorbed.

At the time of the intravenous injection the tissues around the infecting wound should be infiltrated with approximately 10,000 units of antitetanic serum in preparation for wide excision of the wound. This excision should be done an

hour or so later. The saturation of the tissues adjacent to the wound with antitoxin effectively prevents the dissemination and absorption of toxin at the time of operation.

The third step in the treatment of tetanus is the intrathecal injection of 15,000 or 20,000 units of antitetanic serum. This can be given either by lumbar puncture or intracisternally and, of course, should be administered slowly. Recently Dietrich (8) has described the clinical picture of children dying from severe reactions following the intravenous or intracisternal injection of serum. In none of our animals has such a reaction occurred, nor has Vener (24) reported fatal reactions in any of the 75 patients he treated with intrathecal injections. It is highly desirable that a more refined and stronger antitetanic serum be prepared to minimize the possibility of untoward reactions.

The control of convulsive seizures in tetanus is always a major problem. The suggestion that this be accomplished by the use of sufficient amounts of chloral, paraldehyde, or ether-oil per rectum is based largely on experimental work with dogs (10). For this species it seems clear that drugs which are respiratory repressants shorten life. Surprisingly large amounts of paraldehyde (from 10 to 40 cc. per rectum every three hours) can be given to human beings without harm. When necessary, the drug can be administered with normal salt solution by the continuous intravenous drip method. There are a few cases of tetanus in which death is due to laryngeal spasm. When severe stridor occurs, it is wise to perform a tracheotomy and, if necessary, maintain respiration by artificial means. The use of an oxygen tent is of benefit in all severe cases of the disease. It is of fundamental importance, of course, to see that patients with tetanus are kept in fluid and electrolytic balance and are given adequate nourishment.

PASSIVE AND ACTIVE IMMUNIZATION

Passive immunization with antitetanic serum has prevented the development of many cases of the disease but is far from being a satisfactory procedure, largely because there is no way of telling whether or not one should give antitoxin for a particular injury. Every surgeon has had the experience of seeing tetanus develop from an insignificant wound. Indeed, it frequently happens that one is unable to find the point of entrance of the infection. Every practitioner has been disturbed by the severity of the reactions following the use of serum; in addition to malaise, serum sickness, and anaphylactic reactions, instances of peripheral nerve palsies have been reported. Passive immunization with antitetanic serum lasts for only a week or ten days. Consequently, in cases of severe injury or secondary operations it is necessary to repeat the injection. A common mistake in the use of antitetanic serum is that the dosage is frequently calculated in proportion to the age of the patient. Obviously this is a mistake because an infant may have a wound harboring clostridium tetani and producing a great amount of toxin and an adult may have a wound with few organisms producing very little toxin. Consequently, since antitetanic serum is given to neutralize a toxin formed in the wound, the dosage should not be proportional to the age of the patient. During the first World War it was customary to give the second dose of antitoxin while the patient was under general anesthesia. It seems that this procedure lessens the chance of occurrence of severe reactions. Finally, the cost of antitetanic serum is a real deterrent to its use. Some municipalities provide practitioners with the serum for all municipal patients, but often the cost of the injection has to be borne by the doctor. From these observations it is evident that passive immunization with antitetanic serum is not wholly satisfactory.

Active immunization against tetanus has been thoroughly studied during the past decade by Ramon and his associates at the Pasteur Institute. The medical profession of all countries except France was slow to appreciate the importance and effectiveness of this procedure. The present war, however, affords the stimulus necessary to awaken a very keen interest in it. Two kinds of tetanus toxoid have been prepared, the plain and the alum precipitated. In the United States, standards for the potency of each have been set by the National Institute of Health. Most investigators have felt that the alum precipitated produces a better antitoxin response in the patient (12, 16, 23). The method of administering tetanus toxoid is as follows:

An initial dose of 1 cubic centimeter is given subcutaneously. In most instances this produces no appreciable amount of antitoxin. At an interval of from one to three months later a similar injection is given, and within ten days there is detectable antitoxin in the blood. The amount of this antitoxin is practically always sufficient to protect against an ordinary infection. If, however, a third injection of toxoid is given at an interval of from one to three months, the titer of antitoxin in the blood rises rapidly and persists for months. The exact period for which protection is afforded by 3 injections of toxoid is not

accurately known because this substance has not been available long enough. Numerous authors have reported the presence of appreciable amounts of antitoxin in the blood of patients months after a basic course of toxoid had been given. Gold (13) reported the following data on the presence of antitoxin in patients who had received 2 injections of alum precipitated toxoid: after three months 92 per cent of the patients showed at least 0.1 of a unit of antitoxin; after six months 71 per cent showed a similar amount, and after a year 56 per cent; after two years 30 per cent still had 0.1 of a unit of antitoxin.

Unfortunately, there is no quick way of measuring a patient's immunity against tetanus; at present it is necessary to carry out a bio-assay of the patient's serum in guinea pigs. This is time-consuming and expensive. Furthermore, we do not know the minimal amount of antitoxin in the blood that will afford certain protection. It is known, however, that a prophylactic dose of antitetanic serum gives ample protection in the great majority of injuries and that the titer of antitoxin in the blood of an average adult following the usual dose of 1,500 units of antitoxin is from 0.1 to 0.2 of a unit. It would seem, therefore, that such a level gives fair assurance of adequate protection. Following the production of a state of active immunity it is very likely that the level of circulating antitoxin is not an accurate indication of the existing tissue immunity. It is entirely possible that a patient who has had a basic course of 3 injections of toxoid might after some time not have any detectable antitoxin in his blood; nevertheless, this patient would probably have adequate immunity. It is certain that the ability of such a patient to produce large amounts of antitoxin quickly following a fourth injection of toxoid is strong proof of an existing immunity. Whether tetanus toxin produced in the course of the natural disease would similarly stimulate such a patient to produce adequate amounts of antitoxin is not known. It is known that such toxin serves to raise the antitoxin titer in horses previously immunized with toxoid. Shumacker and Lamont (21) have shown that the same effect occurs in guinea pigs. The war now in progress will probably clarify this point. For the present, it seems advisable not to rely solely on the basic course of immunization but to give a fourth injection of toxoid at the time of suspected infection with clostridium tetani, or in the case of soldiers to give the fourth injection shortly before their entrance into a combat zone. Gold (11) has studied the use of an intranasal instillation of a refined concentrated toxoid (Topagen) to replace the third or subsequent doses of toxoid. His results indicate that 2 drops of "topagen" instilled into each nostril on 3 successive days is as stimulating as an additional subcutaneous injection of toxoid.

Maclean and Holt (18) have drawn attention to the important fact that when tetanus toxoid is given with typhoid paratyphoid vaccine, the response to the toxoid is five times greater than when toxoid is given alone.

REACTIONS

All of the early workers in the field of active immunization against tetanus reported either no reactions or an exceedingly small percentage. For instance, Whittingham (25) reported that only 14 reactions of any kind were noted following the immunization of 61,000 soldiers. Two of these 14 reactions were anaphylactic and 12 were classed as constitutional. Gold (14) found only 2 cases of urticaria occurring in 1,700 patients immunized with alum-precipitated toxoid. During the summer of 1941, however, an altogether unexpected outbreak of severe reactions appeared. In some places the incidence was as high as 25 per cent. These reactions followed the injection of both the plain and the alum-precipitated toxoid and occurred after the first as well as after subsequent injections. An intensive study was undertaken to determine the cause of this unfortunate occurrence. It has become increasingly clear that the use of Witte or Berna peptone in the media growing the clostridium tetani was responsible for these reactions. Whenever Martin's peptone has been used for producing toxin and subsequently toxoid, few if any reactions have occurred. The technique of Brewer (26) provides a highly potent toxin practically free from proteins.

The war which has now spread around the globe has already afforded indisputable proof of the effectiveness of active immunization with tetanus toxoid. Practically all the soldiers and horses of the French fighting forces were protected before hostilities commenced. Only 1 soldier is known to have developed tetanus and his case was described as of mild local character. Following the campaign in Flanders there were 8 soldiers in whom clinical tetanus was recognized. These 8 were in a group of 1,800 wounded who had elected to omit injections with toxoid. Among 16,000 who were similarly wounded but immunized, not a single instance of tetanus was recorded.

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MISCELLANEOUS

CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

Cain, J. C., and Belk, W. P.: The Assimilation Rate of Intravenously Injected Glucose in Hospital Patients. *Am. J. M. Sc.*, 1942, 203: 359.

In 1917, Sansum and Woodyatt determined that the tolerance for glucose administered intravenously to the normal healthy adult was 0.85 gm. per kilogram per hour. A glycosuria developed when the concentration was greater regardless of the percentage of the glucose solution that was administered. The amount of glucose lost in the urine was only a portion of that injected, and glycosuria stopped within a few minutes after the injection was discontinued.

The present study was undertaken by the authors to observe the glucose assimilation rate in surgical patients and to learn to what extent this should be taken into account in the practical intravenous administration of glucose when given for fluid balance and other purposes.

Adult patients were studied. Glucose was given by the ordinary gravity drip. The weight of the patient was determined, and the rate of the injection depended upon the amount of solution that was given. The flow of solution was kept constant and urine was collected for twelve hours following the beginning of the injection. Quantitative urine glucose studies were made on this twelve-hour specimen. Comparative observations were also made on the fasting blood sugar, the amount of fluid given, and the grams of glucose per kilogram per hour given and obtained during the twelve-hour period.

In all of the 22 patients who were studied, it was noted that the assimilation of glucose, regardless of the percentage of the solution, was correlated with the rate of injection. The average assimilation was approximately 5.77 gm. per kilogram of body weight per hour. In all cases, some glucose was lost in the urine. This "spill" varied between 0.3 and 30 per cent of the total amount of glucose injected and averaged about 12.2 per cent. The proportion of the glucose lost in the urine depended only upon factors within the individual patients. The proportion of glucose lost does not depend on the percentage of solution given, the rate of administration, nor upon the total amount given. The rate and viscosity of the glucose infusion must be considered in the light of circulatory dynamics of the patient, but these factors are not important in the glucose assimilation by the body tissues. HOWARD A. LINDBERG, M. D.

Steel, J. P.: Phosgene Poisoning. Report on 2 Cases. *Lancet*, 1942, 242: 316.

Steel reports in detail the clinical course of 2 patients exposed to low concentrations of phosgene. The first case was that of a woman thirty-six years of age who had been working in contact with the gas for only a week. On admission to the hospital she had a high temperature, a well marked grey-blue cyanosis, and dyspnea. She was semiconscious, and presented the appearance of extreme toxemia. There was definite, complicating, severe pulmonary edema. The second case was that of a man twenty-four years of age who had been exposed to the gas but six hours. He was delirious, flushed, and likewise had a high temperature. Lung symptoms were present. Both of the patients made rapid and complete recovery under the therapeutic management of complete rest, oxygen, dry heat, antiphlogistine to the chest, abundant fluids, and sedative cough mixtures.

Strict measures to prevent secondary infection by attendants were enforced by requiring all staff members of the hospital to wear protective masks, and by treating the cases in isolation.

The interesting factors concerning these cases not considered characteristic of exposure to the gas were the amnesia and high rise in temperature. Both patients improved rapidly after the first forty-eight hours without any sequelae under the therapeutic regime applied. STEPHEN A. ZIEMAN, M.D.

Smith, D. L., Wells, J. A., and D'Amour, F. E.: The Relationship of the Endocrine System to Carcinogenesis. *Cancer Research*, 1942, 2: 40.

The authors made an attempt to determine whether deficiency or excess of hormones would alter the rate of development of chemically induced tumors. The carcinogen used was methylcholanthrene in a 1 per cent paraffin solution, the total dose being 10 mgm. injected into five sites. Hormone deficiency was produced by extirpation of the gland involved, while excess was produced by injection of the particular hormone. The rate of development was measured in terms of the elapsed time between injection of the carcinogen and the appearance of a tumor having a mass of 1 cc.

Neither the deficiency nor excess of any hormone tested produced great deviation from the normal, although, statistically, significant differences in the direction of increased development were shown by all the groups of rats treated with gonadotropins. In the direction of decreased rate of development, differences were shown by the group treated with hypercortin. These findings were not stressed because of weakness of the technique used.

In view of the extreme physiological contrast between animals completely deprived of a given hormone and animals receiving that hormone in excess, deviations from the normal were not large, under the conditions of the experiment. Since the dose of the carcinogen used was capable of producing tumors in 100 per cent of the control animals, it may have been too large to be affected by the endocrine changes, and a more nearly borderline dose might have given

the endocrines a better opportunity of exerting an influence. ANTHONY F. SAVA, M.D.

GENERAL BACTERIAL, PROTOZOAN, AND PARASITIC INFECTIONS

Lyons, R. H., and Balberor, H.: Febrile Reactions Accompanying the Readministration of Sulfathiazole. *J. Am. M. Ass.*, 1942, 118: 955.

Fifty-three afebrile patients who received one course of sulfathiazole without complications were given a second course of the drug, usually for experimental purposes. Thirty-six of these patients received the initial course of sulfathiazole for therapeutic purposes for from two to eighteen days (mean five and eight-tenths days) with clinical remission of their disease. Seventeen afebrile patients with no evidence of infection were considered controls and received the initial course of sulfathiazole for two days. The second course was started from two to twenty days (mean seven and eight-tenths days) after the completion of the first course.

A course of sulfathiazole consisted of an initial dose of 4 gm. followed by 1 gm. every four hours. The second course was given in exactly the same manner and continued for from two to seven days unless a febrile reaction occurred.

Nineteen of 53 patients (36 per cent) to whom sulfathiazole was readministered experienced a febrile reaction shortly after the beginning of the second course, although no fever attributable to the drug was experienced during the first course. Febrile reactions were characterized by a sharp rise in temperature from 102° to 106°F. and were often accompanied by chills and associated with prostration and weakness. The high incidence of fever (36 per cent) associated with the readministration of sulfathiazole strongly suggests that the use of the drug is accompanied by more danger than was formerly believed. Not only is the patient exposed to the usual toxic effects of the drug and to the deposition of crystals in the urinary tract, but also he may become predisposed to the development of a severe febrile reaction should it be necessary to repeat the drug at a later date. Therefore, it is apparent that the use of sulfathiazole should be reserved for the more virulent and serious infections. Eight of 10 patients who had a thermal reaction with the second course experienced a similar reaction when given a third course of the drug. Certain patients had multiple febrile reactions when given repeated courses of sulfathiazole.

It is possible that sulfathiazole when introduced into the body may develop antigenic properties which in certain instances produce a state of hypersensitivity. The manifestation of this hypersensitivity in these cases is the febrile response. The fact that in the patients studied an interval of at least nine days was necessary between the first contact with the drug and the occurrence of a febrile reaction on readministration of the drug favors this assumption. Further evidence lies in the ability to reproduce the reaction repeatedly even after intervals of as long as forty-one days. Occasionally it is possible to produce such a high degree of hypersensitivity to the drug that very small doses may elicit a febrile response. If the sensitized person is given a succession of small doses, the febrile response to a full 4 gm. dose apparently diminishes in severity. It is possible that small doses partially desensitize the patient to sulfathiazole. The relative specificity of the reaction also points toward the antigenic nature of the drug. Sulfapyridine and sulfanilamide were tolerated without difficulty when administered to patients who had exhibited at least one febrile reaction to sulfathiazole. SAMUEL H. KLEIN, M.D.

Hawking, F.: Sulfonamide Compounds in Feces. Results with Cat Feces and with Human Feces; Effect on Fecal Bacteria. *Lancet*, 1942, 242: 290.

This paper describes an investigation of the fecal concentrations obtained after oral administration of various sulfonamides to cats, mice, and men. The feces of cats often contained high concentrations of all the compounds examined but these animals seemed unsatisfactory for investigating sulfonamide excretion in feces since the amount of absorption bore little relation to that found in human subjects. In mice, sulfathiazole seemed more effective than sulfaguanidine in diminishing the number of bacteria in the feces but the doses had to be toxic.

Observations on human feces were made on 22 subjects, of whom 18 were volunteers. In normal individuals, sulfaguanidine was excreted in high concentrations, while sulfapyridine, sulfathiazole, sulfadiazine, and sulfanilyl-benzamide were found only in fairly low concentrations. These results apparently encourage the belief that sulfaguanidine may prove particularly suitable for the treatment of bacillary dysentery. WALTER H. NADLER, M.D.

EXPERIMENTAL SURGERY

Dexter, L., and Braun Menéndez, E.: Urinary Elimination of Renin (La eliminación de renina en la orina). *Rev. Soc. argent. de biol.*, 1941, 17: 394.

More than 200 units of renin have to be injected in the blood stream of dogs in order to recover a dosable amount in the urine.

From 6 to 42 per cent of the injected substance is eliminated two hours after the injection, most of it within the first hour.

The urinary excretion of renin or reninlike substances does not seem to play an important role in the disappearance of renin from the blood stream. Even in cases of experimental or clinical hypertension (from 180 to 240 mm. Hg) no renin could be found in the urine. EMANUELE MOMIGLIANO, M.D.

Taquini, A. C., and Braun Menéndez, E.: Renin Release after Total Ischemia of the Kidneys (Liberacion de la renina por el riñón totalmente isquemiado). *Rev. Soc. argent. de biol.*, 1941, 17: 465.

Clamping of the renal artery (in dogs) for 6 hours produces a marked accumulation of renin in the

ischemic organ. The re-establishment of the blood circulation is followed by a washing out of the accumulated substance as shown by a comparative determination of the renin in perfusing liquids or in the blood drawn from the renal veins or the carotid arteries. The amount of renin drops sharply within a few minutes after the re-establishment of the blood circulation.

The accumulation of renin is due to a gradual thrombosis of the blood vessels, as shown by a decreased quantity of blood supply.

The quantity of renin in the carotid blood may reach 1 unit per cc. of plasma. No hypertension could be detected in the renal veins. Renin, therefore, seems solely responsible for the increased blood pressure following prolonged ischemia of the kidneys.

EMANUELE MOMIGLIANO, M.D.

Hinkel, C. L.: The Effect of Roentgen Rays upon the Growing Long Bones of Albino Rats. Quantitative Studies of the Growth Limitation Following Irradiation. *Am. J. Roentgenol.*, 1942, 47: 439.

Seventy-three per cent of the postnatal growth in the femur of the albino rat takes place at the distal extremity; there is a constant relationship between the logarithm of the bone length and the reciprocal of age.

The application of roentgen rays to the growing epiphyseal region produces quantitatively predictable degrees of stunting ranging from temporary retardation to permanent cessation of growth, the degree depending upon the dose administered. The amount of radiation required to produce minimal stunting bears a linear relationship to the age of the animal treated and cannot be correlated with the rapidity of growth or skin effect.

Controlled radiation stunting is temporary and measurable growth soon reappears. Young animals recover more quickly than older animals and can tolerate quantities of roentgen rays far greater than the minimal stunting dose.

Artificial retardation of bone growth may prove to be applicable for clinical use when it is deemed advisable to equalize the lengths of asymmetrical bones.

HAROLD C. OCHSNER, M.D.

Rugiero, H. R., and Tanturi, C. A.: Studies on Inflammation. Relation between the Local Cellular Picture and the pH (Estudios sobre inflamación. Relación entre el caudro celular local y el pH). *Semana méd.*, 1942, 49: 337.

The cellular response to chemical, physical, or microbial irritants has been studied in detail by many investigators. It has been proved that within four hours of the introduction of inflammatory material, great numbers of polynuclear leucocytes migrate from the blood vessels to the site of inflammation. With the disappearance of bacteria, the mononuclear cells increase and begin to ingest the destroyed material.

In 1934, Menkin showed experimentally that while inflammation progresses, the concentration of the hydrogen ions changes from alkalinity to acidity. As alkalinity decreases, the percentage of polynuclears decreases while the mononuclears increase. The lymphocytes have no part in this exchange. Examination revealed that the percentage of polynuclears predominates when the pH is alkaline and inversely when the concentration of ions is elevated. By studying the pH, the cytological picture of the exudate can be predicted and *vice versa*.

Thus, all investigators agree on the type of cellular response in an inflammatory process. However, no one before Menkin compared the leucocytic formula with the processes that occur at the site of inflammation.

The authors performed experiments similar to those of Menkin to confirm his findings. They produced an inflammatory pleural reaction by introducing 1, 2, or 3 cc. of turpentine into the pleural cavity of an unanesthetized animal. Following this, there was a reaction of shock, convulsions, and pain lasting for from six to eight hours, after which the animal apparently recovered. The results of these experiments corresponded closely to those of Menkin and the authors drew the following conclusions:

1. The correlation between the pH and the local cytological picture in the pleural inflammatory exudate, induced by turpentine, suggests that the hydrogen ion concentration is the factor which conditions the cellular type of the exudate.

2. With an average pH of 7.43, the number of polynuclear leucocytes was raised to 60, and with an average pH of 6.88 the percentage was lowered.

3. When the pH was below 6.60, the polynuclears showed evident signs of degeneration and the exudate had all the characteristics of pus.

4. Thus, in an inflammatory exudate with an alkaline pH the polynuclear leucocytes predominate, whereas in those with an acid pH, mononuclear leucocytes predominate. MICHAEL DEBAKEY, M.D.

Roffo, A. H., and Luchetta, B.: Cancer and Tobacco (Cancer y tabaco). *Nuevas ideas*, 1942, 16: 36.

The authors have previously recorded the production of cancer in rabbits by the use of a tar extracted from tobacco. The active ingredient of the tar seems to correspond chemically and physically to 1, 2 benzopyrene.

At this time, 6 experimental rabbits were used, 3 of them having tobacco tar applied to the inner surface of the ear every other day for several months, and the other 3 being kept for controls. Blood samples were removed once each month for analysis. The first papillomas appeared in the treated rabbits in three months and showed definite malignant changes five months later. After sixteen months, 1 rabbit died and the remainder were sacrificed for post-mortem examinations. The control animals did not develop any tumors.

All of the elements of the hematic series showed more or less pronounced modifications, the reticulocytes showing the most interesting changes, which can be divided into three stages: (1) moderate irri-

tation of the hematopoietic sector of the bone marrow with the entrance into the circulation of a great number of immature red cells; (2) accompanying the appearance of the papillomas, evidence of greater irritation of the bone marrow with the entrance of a still larger number of immature red cells; and (3) coincident with the malignant degeneration of the papillomas and general cachexia, disintegration and disappearance of the reticulocytes.

The general hematological picture showed two distinct stages, one coinciding with the precancerous period and the second with the development of the cancerous lesion. The precancerous stage was characterized by a regenerative or plastic type of anemia with neutrophilia and monocytosis; the cancerous stage was characterized by an aplastic type of anemia and diminution of the neutrophiles and monocytes.

FRANK MCDOWELL, M.D.

MEDICAL JURISPRUDENCE

Hibben, J. S.: Physical Medicine. *J. Am. M. Ass.*, 1942, 118: 1038.

The author discusses in detail the medicolegal aspects of physical medicine, the prevention of legal claims, and the methods to be employed by the physician to safeguard himself.

All physical-therapy apparatus used should bear the stamp of approval of the Council on Physical Therapy of the American Medical Association. The assistants should be trained registered technicians.

It is pointed out that the physician assumes a medicolegal responsibility when he prescribes any form of physical therapy. His instructions should be explicit and preferably in writing. Consultation, when necessary, is reassuring and valuable as a safeguard. Only well established and safe physiotherapeutic measures should be employed.

J. M. MORA, M.D.

Bureau of Legal Medicine and Legislation: Cancer Allegedly Resulting from Trauma. Medicolegal Abstract. *J. Am. M. Ass.*, 1942, 118: 557.

A claim that in the course of employment a woman suffered an injury to the breast and within two years died from cancer came up for review by the Supreme Court of Tennessee. The usual sides were taken by conflicting medical testimony. For the claimant it was asserted that her death was attributable to cancer of the breast which made its appearance seven months after the alleged trauma. Contrary to this was medical testimony to the effect that the cause of cancer is not trauma, and reference was made to the opinion of Francis Ward who stated that trauma is one of the two most common lay superstitions regarding the cause of cancer.

The Supreme Court of Tennessee found in favor of the employer because the proof offered by the claimant did not establish as a fact that the employee had died as a result of a cancer caused by an industrial injury. The court decided that in view of medical testimony, to hold that the cancer on the victim's breast was caused by the blow received in the course of her employment would be pure speculation, conjecture, and guess.

ANTHONY F. SAVA, M.D.